



TABLE  
OF  
CONTENTS

# **BASIC HI-CAP MAINTENANCE**

## **TABLE OF CONTENTS**

	<b>PAGE</b>
<b>COURSE OBJECTIVE</b>	
Introduction . . . . .	1
Given . . . . .	1
Action . . . . .	1
GTEP References . . . . .	2
Other References . . . . .	3
<b>INTRODUCTION TO DS1 HI-CAP</b>	
Description . . . . .	5
Examples of Uses . . . . .	6
Customer Benefits . . . . .	7
Telco Benefits . . . . .	8
Program Purpose . . . . .	8
<b>BASIC HI-CAP CIRCUIT DESIGN</b>	
Overall Layout . . . . .	9
CSU . . . . .	10
NIU . . . . .	11
Span . . . . .	13
MDF . . . . .	15
OTR . . . . .	16
DSX . . . . .	19
<b>MAINTENANCE RESPONSIBILITIES</b>	
CRCC . . . . .	23
C.O. Maintenance . . . . .	24
Span Maintenance . . . . .	26

continued . . .

# BASIC HI-CAP MAINTENANCE

## TABLE OF CONTENTS

	PAGE
<b>FACILITY LAYOUT RECORD</b>	
Purpose .....	29
Key Fields .....	29
<b>CIRCUIT LAYOUT RECORD</b>	
Introduction .....	35
Key Fields .....	39
<b>DS1 SIGNAL CHARACTERISTICS</b>	
Line Coding .....	44
<i>Alternate Mark Inversion</i> .....	44
<i>Bipolar 8-Bit Zero Substitution</i> .....	45
Frame Formats .....	47
<b>TEST METHODS AND ACCESS</b>	
In-Service Testing .....	49
Out-of-Service Testing .....	53
<i>Description</i> .....	53
<i>Test Methods</i> .....	53
<i>Test Patterns</i> .....	55
Span Power Tests .....	56
<i>Span Line Powering</i> .....	56
<i>Simplex Powering</i> .....	59
Frame Test Access .....	61

continued . . .

**TABLE OF CONTENTS**

**PAGE**

**TEST PROCEDURES**

Test Procedures  
Trouble Scenarios

**GLOSSARY**

**APPENDIX**

Technical Information - Additional Terms  
PSB 1000  
GTEP 200-050-101  
Questions

**COURSE COMPLETION FORM**

**BASIC HI-CAP MAINTENANCE - LAB COURSE NO. 50403**

# BASIC HI-CAP MAINTENANCE

## COURSE OBJECTIVE

### **Introduction**

This Course provides you with:

- An understanding of the basic circuit design for a DS1 High-Capacity Digital Service (Hi-Cap).
- The importance of prompt response to trouble reports.
- Maintenance responsibilities.
- DS1 Hi-Cap trouble isolation procedures:
  - In-Service testing.
  - Out-of-service testing via an NIU loop.
  - Span power measurements.
  - Isolation of trouble in or out of the Central Office.
- Facility Layout Records and Circuit Layout Record key field definition and use.

### **Given**

- Student Manual
- One-Touch Interactive Viewer Response System
- Test Equipment Explanations and Setup Procedures

### **Action**

You will answer questions about:

- Hi-Cap service offering.
- GTE's service commitment.
- Work group responsibilities.
- Test access and methods.
- Trouble isolation procedures.
- The proper handling of a trouble report.

(continued)

# BASIC HI-CAP MAINTENANCE

## COURSE OBJECTIVE, continued

### **GTEP References**

The following GTEPs are referenced in this Course:

GTEP NUMBER	TITLE
200-002-725	Acceptance Testing - DS1 Span
200-050-101	Special Service Circuits Safeguarding and Marking
243-120-200	Cook Electric Protectors - Description and Installation
835-000-071	T1 PCM Repeatered Line - Transmission Considerations for Engineering
836-910-080	Digital Signal Cross-Connects (DSX)

(continued)

## BASIC HI-CAP MAINTENANCE

### COURSE OBJECTIVE, continued

#### **Other References**

The following references were also used in this Course:

REFERENCE	DESCRIPTION
TTC	Telecommunications Techniques Corporation (TTC) equipment specification sheets and notes: <ul style="list-style-type: none"><li>• T-BERD 209A Users Manual</li><li>• T-BERD part number</li><li>• T1 testing with the T-BERD 209A/211</li></ul>
TR-NPL-000054	Belcore Technical Reference, High-Capacity Digital Service
Westell	Westell T1 equipment specification sheets: <ul style="list-style-type: none"><li>• 30C T1 Loopback Transmitter</li><li>• 3110-02G T1 Facility Loopback Unit</li><li>• 3195-81 T1 Span Simulator Operation Guide</li></ul>
Xel	Xel T1 equipment specification sheets: <ul style="list-style-type: none"><li>• 4420 - Network Interface Device (NID)</li><li>• 4460 - Network Interface Device (NID)</li><li>• 7853-100 - Line Repeater w/Remote Loopback</li></ul>
Teltrend	Teltrend T1 equipment specification sheets for 514-LG

(continued)

## BASIC HI-CAP MAINTENANCE

### COURSE OBJECTIVE, continued

#### ***Other References, continued***

REFERENCE	DESCRIPTION
LCI Course No. 00501	T1 Digital Networks (Learner-Controlled Instruction consisting of five videocassette training tapes and a workbook)
Videocassette Programs	<ul style="list-style-type: none"><li>• V-4115 - Analog to Digital: An Introduction to PCM (available from VisNet)</li><li>• T-BERD 209A/211 Video Training Guide (available from TTC)</li></ul>
Course No. 50620	T1/Hi-Cap Turn-Up and Testing (40 hrs.) (Virginia and North Carolina)
Course No. 50628	DS-1 Testing (24 hrs.) (Florida and North Carolina)
Course No. 50691	PCM Skills Enhancement (40 hrs.) (California)
Course No. 50702	T-1 Span Maintenance (28 hrs.) (Texas)
Course No. 50706	PCM Carrier Patching (8 hrs.) (Texas)

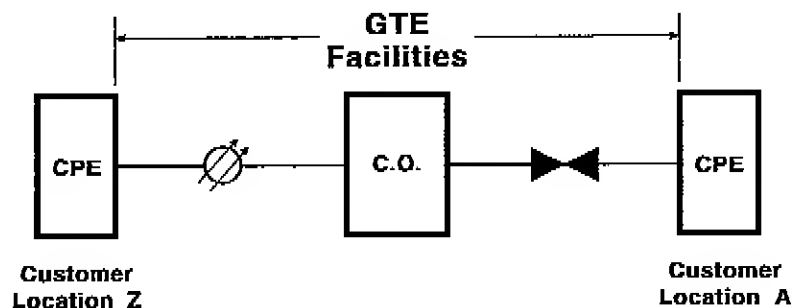
## BASIC HI-CAP MAINTENANCE

### INTRODUCTION TO DS1 HI-CAP

#### **Description**

High Capacity Digital Signal level 1 (DS1 Hi-Cap) service is one type of Hi-Cap available to customers. Other broadband or higher speed Hi-Caps such as DS2 or DS3 can also be ordered. However, the focus of this program deals with DS1 service. A DS1 Hi-Cap is:

- A point-to-point service.
- 1.544 Mb/s digital pipe.
- Identified by a unique private line circuit number.



(continued)

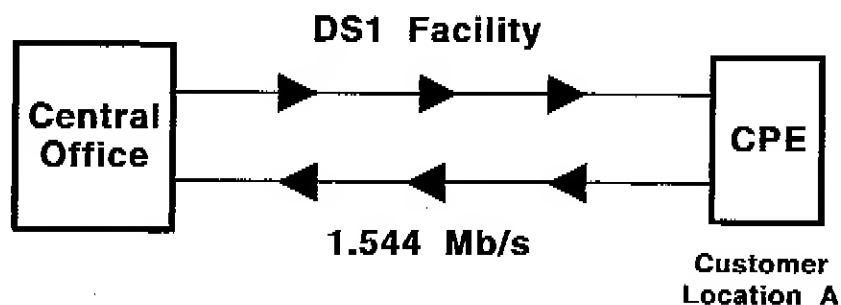
## BASIC HI-CAP MAINTENANCE

### INTRODUCTION TO DS1 HI-CAP, continued

#### *Examples of Uses*

The DS1 Hi-Cap was retariffed in the early 1980s to allow substantial cost savings to customers with multiple circuits between two locations. Growth rates have continued to climb with customer requirements for interlocation connectivity for services such as:

- LAN/WAN connectivity for data transfer/sharing.
- Medical data transfer (X ray, CAT scan).
- Main frame computer links.
- Videoconferencing.
- PBX connectivity.
- Connect cellular sites.
- Interexchange Carrier (IC).



(continued)

## BASIC HI-CAP MAINTENANCE

### INTRODUCTION TO DS1 HI-CAP, continued

#### ***Customer Benefits***

Some of the drivers behind customer orders for Hi-Cap service are:

- Flexibility - handles voice and/or data services.
- Cost savings.
- Improved quality over analog lines.
- Increased capacity over conventional lines:
  - 1 to 24 standard voice/data channels (DSOs).
  - 1-X Wideband data channel(s).
- Guaranteed Service (Performance Commitment Program):
  - Restoration in under 3 hours.
  - Available 99.925 percent annually.

**NOTE:** Our largest customer, AT&T, is requesting service restoral within 30 minutes. Current service restoration times do **not** meet our customer's expectations! To remain competitive, we *must* improve our response time.

(continued)

## BASIC HI-CAP MAINTENANCE

### INTRODUCTION TO DS1 HI-CAP, continued

---

#### ***Telco Benefits***

Telephone Company (telco) benefits include:

- Increased Revenue (\$9 million per month in California alone).
- High growth rate:
  - 30 to 80 percent annually around the country.
  - Approximately 130 new circuits per month in California alone.

---

#### ***Program Purpose***

Due to the high visibility and revenue related to these services, we *must* take a closer look at ways to isolate and resolve customer-reported troubles. Our goals are to:

- Reduce the Hi-Cap outage time.
  - Exceed our customer's expectations.
  - Work as a team.
  - Enhance your technical skills.
-

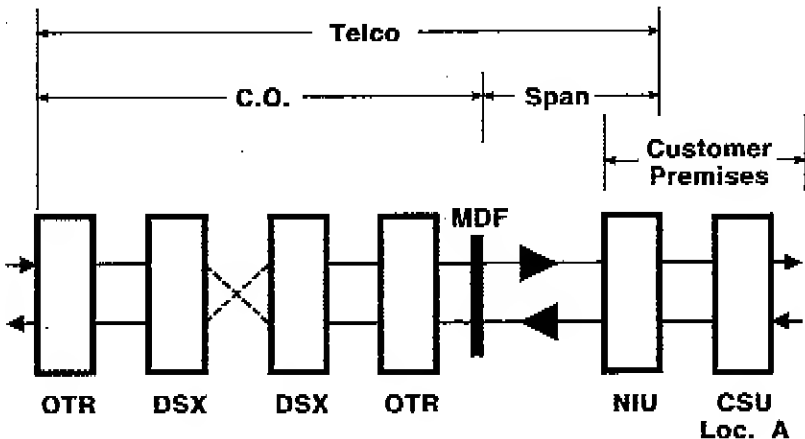
## BASIC HI-CAP MAINTENANCE

## BASIC HI-CAP CIRCUIT DESIGN

## Overall Layout

The overall circuit layout of a typical DS1 Hi-Cap is a point-to-point circuit from customer location A to customer location Z, consisting of:

- Customer-Provided Equipment (CPE) such as a:
  - Channel Service Unit (CSU).
  - Multiplexer (MUX) or Private Automatic Branch Exchange (PABX).
- Telco equipment such as:
  - A Network Interface Unit (NIU).
  - Local span facilities (either copper or fiber).
  - A central office Main Distribution Frame (MDF).
  - An Office-Terminating Repeater (OTR).
  - A Digital Signal Cross-Connect (DSX).
  - An OTR or Multiplex equipment to/from the Far End location, which may be identical to the Near End equipment.



(continued)

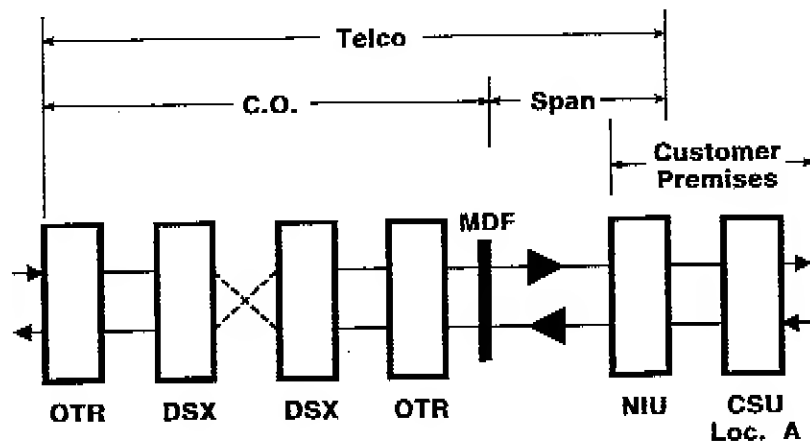
## BASIC HI-CAP MAINTENANCE

### BASIC HI-CAP CIRCUIT DESIGN, continued

#### CSU

The Channel Service Unit (CSU) is also referred to as the Customer Service Unit in some publications and:

- Is located at the customer's premises.
- Is considered Customer-Provided Equipment.
- Interfaces the network facility to the CPE, yet is not required on all circuits.
- Monitors the receive signal for error-checking.
- Allows loopback testing.
- Determines signal format.



(continued)

## BASIC HI-CAP MAINTENANCE

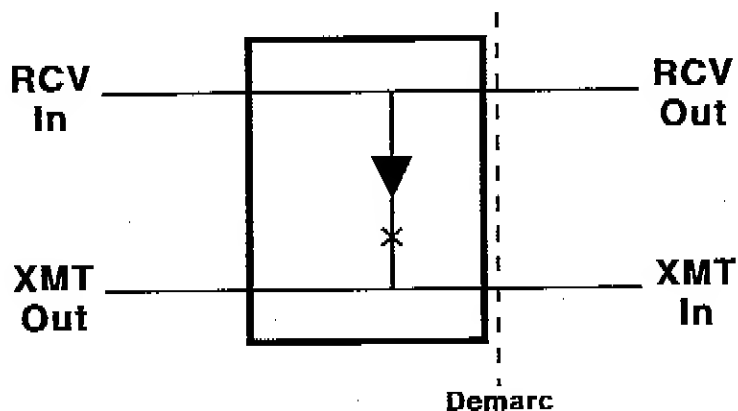
### BASIC HI-CAP CIRCUIT DESIGN, continued

#### **NIU**

The Network Interface Unit (NIU):

- Is located at the customer's premises.
- GTE-provided equipment.
- Terminates copper span facilities.
- Is powered by the span line.
- Can be the span power-looping point.
- Has remote loopback on command for testing.
- Is the point of demarcation.

**NOTE:** The NIU is sometimes referred to as the *smart jack* in some trade publications.



(continued)

## **BASIC HI-CAP MAINTENANCE**

### **NOTES**

## BASIC HI-CAP MAINTENANCE

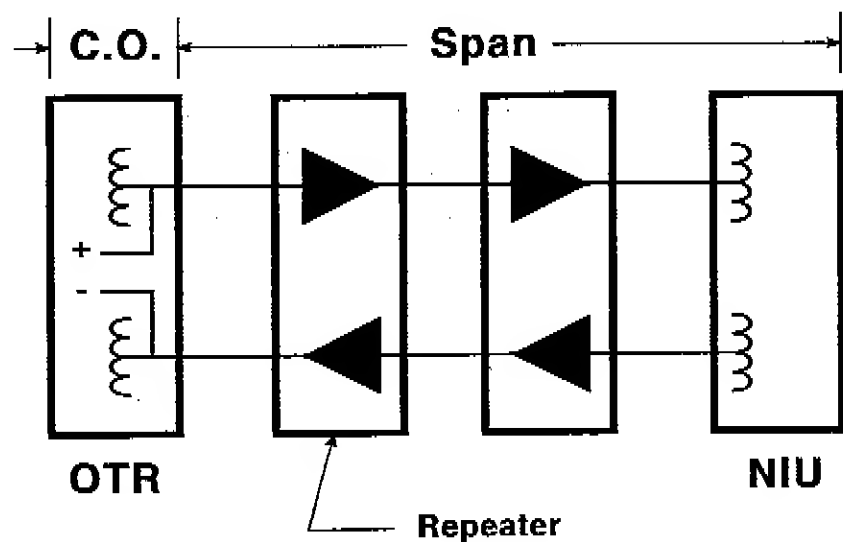
### BASIC HI-CAP CIRCUIT DESIGN, continued

#### **Span**

The span line facility:

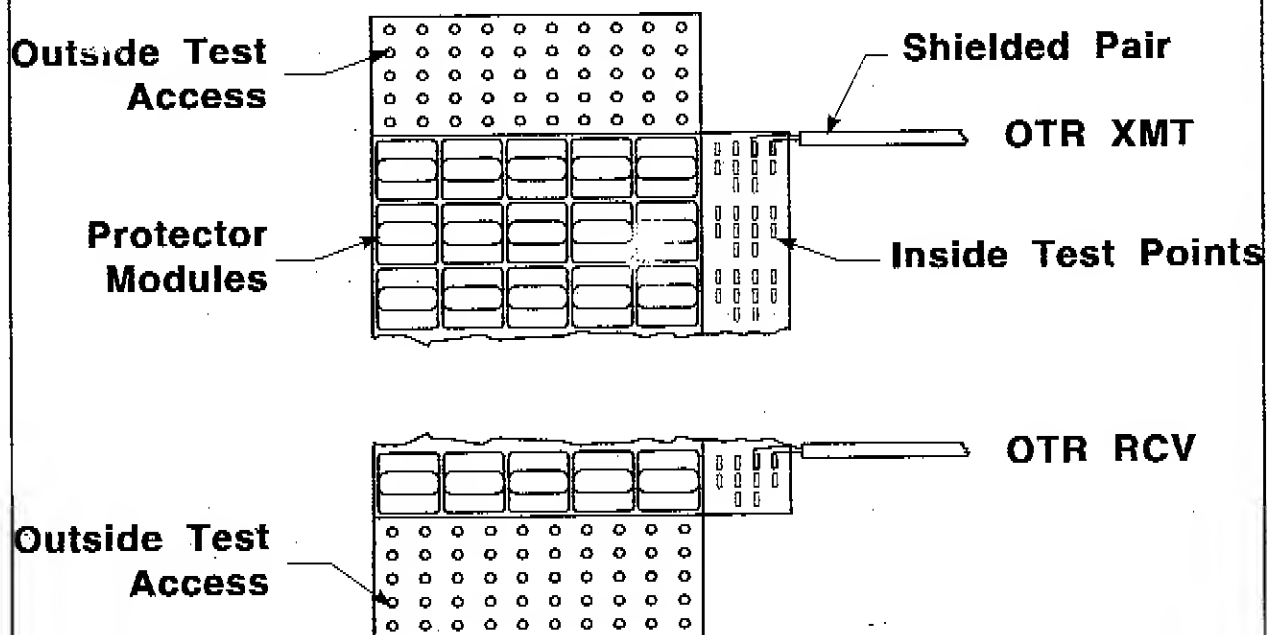
- Has a DS1 pipe extended over copper facilities.
- Has two cable pairs (4-wire circuit).
- Extends from the Central Office (C.O.) to the customer's premises.
- May or may not contain field repeaters (regenerators).
- Field repeaters are powered from the C.O.

**NOTE:** The majority of Hi-Cap service to the customer is provided on copper span facilities.



(continued)

## BASIC HI-CAP MAINTENANCE



MAIN DISTRIBUTION FRAME (TYPE 303)

## BASIC HI-CAP MAINTENANCE

### BASIC HI-CAP CIRCUIT DESIGN, continued

#### **MDF**

The Main Distribution Frame (MDF) has:

- C.O. span cable termination capabilities.
- Protector module:
  - Point-of-surge voltage protection.
  - Solid-state voltage-limiting device.
  - 270-volt rating.
  - Red case.
  - An isolation device for inside and outside cable/equipment.
  - Long pins are the *Tip* and *Ring* outside plant conductors (Long = Local Loop).
  - Short pins are the *Tip* and *Ring* of the C.O. equipment.
  - Insert to the indent position (partially in) to disconnect the C.O. while maintaining protection in the outside plant.

**NOTE:** Refer to GTEP **243-120-200** for additional information.

The following precautions are observed:

- Special Safeguard Marking Order (SSMO) treatment.
- Binder group and pair separation to prevent signal interference. The transmit and receive cable pairs will be on split counts within the cable.

**NOTE:** The C.O. pair connection will have a shielded cable wired to the office repeater equipment. There are two shielded pair connections per circuit.

---

(continued)

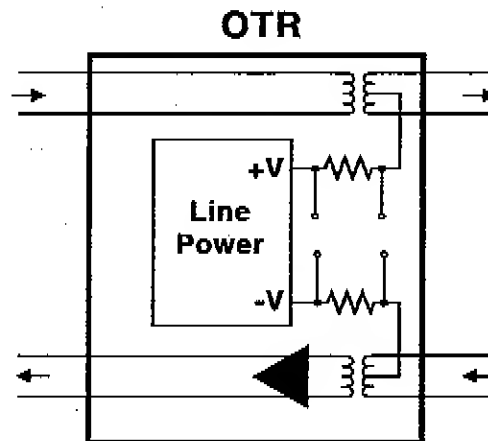
## BASIC HI-CAP MAINTENANCE

### BASIC HI-CAP CIRCUIT DESIGN, continued

#### **OTR**

The Office-Terminating Repeater (OTR):

- Is located in the C.O.
- Provides regulated current to power span equipment:
  - Power for the field repeaters when equipped.
  - Provides test jacks to measure span power.
  - Provides power to the NIU at the customer's premises.
- (See page 58 for simplex power fundamentals.)
- Regenerates the receive DS1 signal from the customer.



(continued)

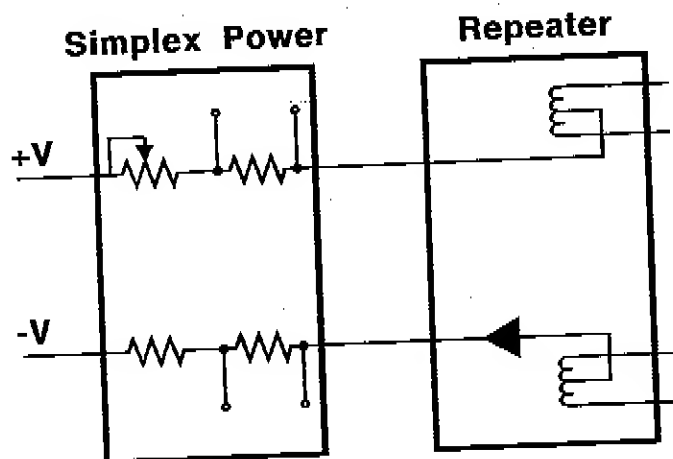
## BASIC HI-CAP MAINTENANCE

### BASIC HI-CAP CIRCUIT DESIGN, continued

#### ***OTR, continued***

Although various OTRs are in use, they all provide the same functions. Each has its own layout and options. Always refer to the vendor's specifications for each model. The size, designations, test points, and options will vary, depending on the type. Some Lenkurt equipment actually consists of two cards to perform the OTR functions:

- Repeater card for receive signal regeneration
- Simplex power card that provides simplex current



(continued)

## BASIC HI-CAP MAINTENANCE

### DSX Bay Layout

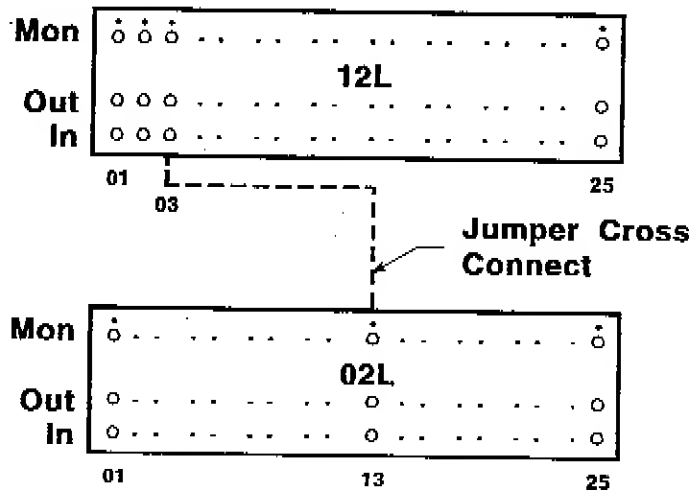
12L	12R

03L	03R
02L	02R
01L	01R

Module No.  
(Panel)

Bay No. 12920

### DSX Jackfield



Bay No. 12920

DSX

## **BASIC HI-CAP MAINTENANCE**

### **BASIC HI-CAP CIRCUIT DESIGN, continued**

#### **DSX**

The Digital Signal Cross-Connect jack fields:

- Provide a common point of interconnection of DS1 facilities through the C.O.
- Provide a lamp (LED) indicator for cross-connected facilities.
- Are directly cabled to OTR equipment shelves.
- Are directly cabled to other DS1 ports or multiplex equipment such as:
  - Fiber multiplex DS1 channels.
  - C.O. DS1 digital interface facilities/ports.
- Provide easy DS1 test access to:
  - Monitor circuits.
  - Test circuits.
  - Isolate trouble.
  - Provide facility manual looping via a patch cord.
  - Service restoration via patching to another facility, if another facility is available.

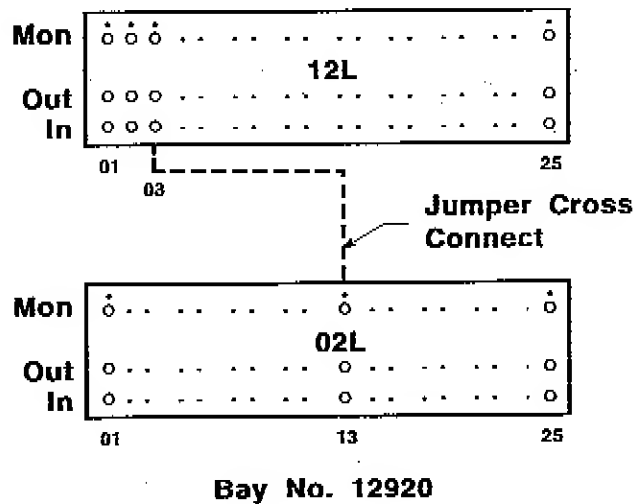
**NOTE:** Industry standards exist for signal characteristics at the DSX.

---

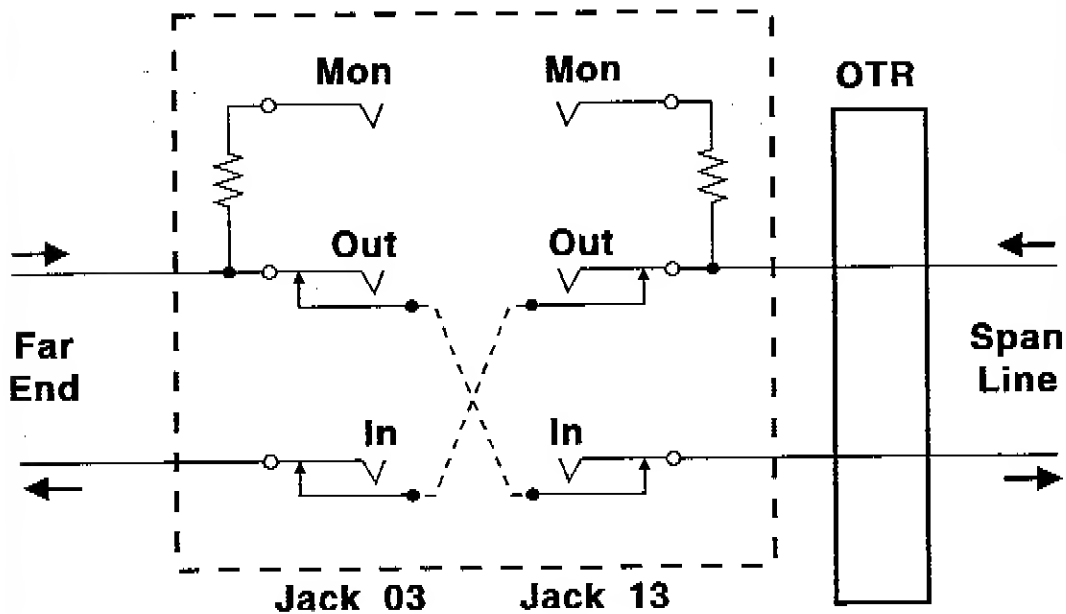
(continued)

## BASIC HI-CAP MAINTENANCE

### DSX Jackfield



### DSX Schematic



DSX

## BASIC HI-CAP MAINTENANCE

### BASIC HI-CAP CIRCUIT DESIGN, continued

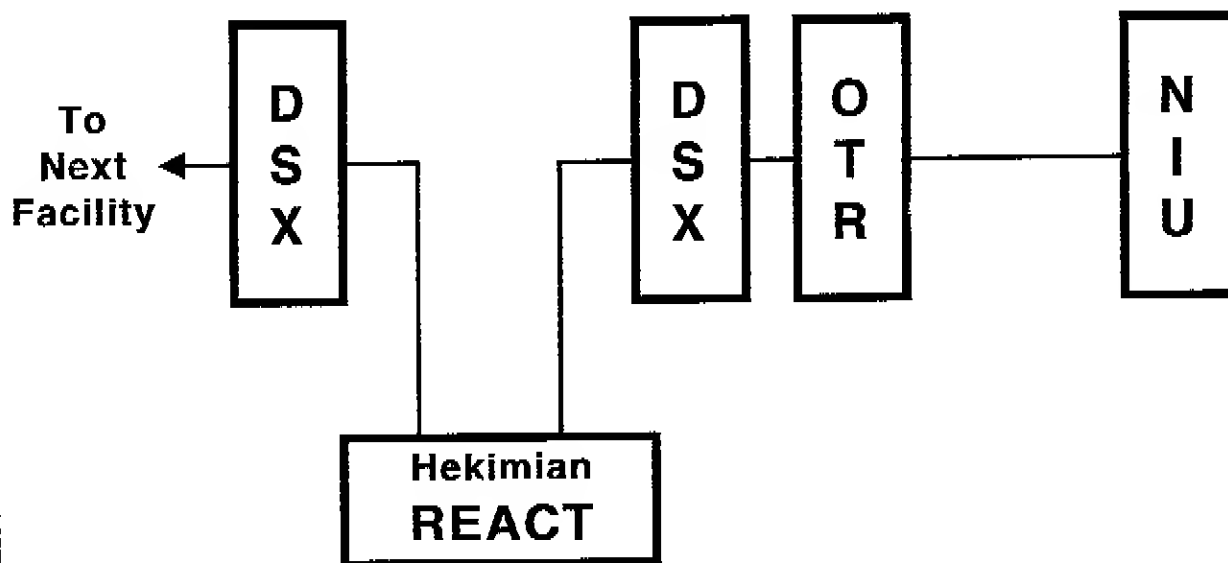
#### ***DSX, continued***

**CAUTION:** IN and OUT jacks are open-type jacks, that is, when a plug or cord is inserted into the jack the signal is interrupted. Plugging into either jack *will* cause a *service interruption* to the customer. Even attempting to make a "hot" patch will cause data hits to the customer. Do **not** use these jacks unless proper authorization has been provided.

The DSX jacks provided on each DS1 facility are:

JACK	PURPOSE	EXPLANATION
MON	<ul style="list-style-type: none"><li>• Is connected to the "OUT" jack through an isolation resistor.</li><li>• Allows you to check circuit quality without interrupting service by monitoring the customer's "live" signal with a DS1 test set or analyzer.</li></ul>	Inserting a plug or cord in the monitor jack illuminates the LED immediately above the jack and the LED above the corresponding cross-connected facility (if the trace lead "TL" jumper is installed).
OUT	<ul style="list-style-type: none"><li>• Is directly cabled to the receive signal of the facility.</li><li>• Carries the signal coming out of the span or out of the terminal or out of the switch.</li></ul>	The OUT jack of one DS1 facility is connected to the IN jack of another DS1 facility.
IN	<ul style="list-style-type: none"><li>• Is directly cabled to the transmit side of the facility.</li><li>• Carries the signal going into the span or into the terminal or into switch.</li></ul>	The IN jack of one DS1 facility is connected to the OUT jack of another facility.

## BASIC HI-CAP MAINTENANCE



REACT POSITION IN CIRCUIT

## **BASIC HI-CAP MAINTENANCE**

### **MAINTENANCE RESPONSIBILITIES**

#### **CRCC**

The following maintenance responsibilities apply to California and some other metroplex areas. Consult with your supervisor for local guidelines. In any case, someone *must* accept the responsibilities outlined below.

The Carrier Restoration Control Center (CRCC) (a.k.a. Facility Hub) maintenance responsibilities are as follows:

- Overall Hi-Cap circuit restoration:
  - Coordinates isolation/restoration of DS1 and higher facilities.
  - Directs span maintenance.
  - Directs C.O. maintenance (refer the trouble ticket to the C.O.).
- Remote Access Circuit Testing (REACT) for some circuits via the Hekimian equipment, including:
  - In-Service Testing.
  - Out-of-Service Testing.
- Retain a copy of all FLRs.

---

(continued)

## BASIC HI-CAP MAINTENANCE

### MAINTENANCE RESPONSIBILITIES, continued

#### **CRCC, continued,**

- Customer Interface including:
  - Trouble clearing/final customer acceptance.
  - Public relations.
  - Coordinate cooperative testing between GTE personnel and the customer.

**NOTE:** The Enhanced Switched Access Remote Test System (ESARTS) widely used for special service testing is intended to allow remote testing of DS1 facilities. However, ESARTS currently **cannot** perform remote DS1 testing functions.

#### **C.O. Maintenance**

The C.O. Maintainer plays a vital role in meeting the service objectives of our Hi-Cap customers, as follows:

- Verify and Retain Records:
  - DSX Trace Cards
  - Repeater Trace Cards
  - FLR obtained from Special Service Operations (SSO)

(continued)

## BASIC HI-CAP MAINTENANCE

### MAINTENANCE RESPONSIBILITIES, continued

#### **C.O. Maintenance, continued**

- SSMO Treatment (see GTEP **200-050-101** in the Appendix):
  - Red tags on MDF, OTR, DSX.
  - Terminal protection on every jumper tie down (red)(Material Code 31551).
  - DSX jack protective plugs are in all IN/OUT jacks (blue) (Material Code 354400).
  - MDF solid-state, 270-volt modules (red).
- Isolate trouble in or out of the C.O. as covered in the test methods and procedures Section:
  - In-service monitoring, also called **non-intrusive testing**, checks the customer's signal for errors without interfering with the customer's traffic.
  - Out-of-service testing, also called **intrusive testing**, is performed by manually interrupting the customers's circuit and inserting a test signal to verify the circuit quality.
  - Repeater power measurements.
  - MDF voltage and continuity testing
- Assist in-service restoration:
  - Patching interoffice facilities (CRCC).
  - Repairing C.O. faults.
  - Performing test/repairs with span maintenance.
- Maintain Test Equipment availability and operational status.

(continued)

## BASIC HI-CAP MAINTENANCE

### MAINTENANCE RESPONSIBILITIES, continued

#### ***Span Maintenance***

The Span Maintenance crew's responsibilities are as follows:

- Repair local copper span facilities from:
  - C.O. to C.O.
  - The end user to the C.O.
- Cooperative testing from the premises to the Far End (FE) user
- Inspections on new turn-ups:
  - SSMO treatment throughout the circuit
  - Verify span repeater locations
  - Verify proper equipment placement at the customer's premises
- Retain Records:
  - Facility Layout Record (FLR)
  - Transmission Engineering Directives (TEDs)

## **BASIC HI-CAP MAINTENANCE**

### ***NOTES***

# BASIC HI-CAP MAINTENANCE

③ CXR RTE: 16599A      FACILITIES INVENTORY MANAGEMENT SYSTEM      PAGE 1 OF 1  
 ④ DESIG: 101      \*\*\*FACILITY LAYOUT RECORD\*\*\*      RPT ID: LF104530  
 TYPE: POI      DERIVED FACILITY SYSTEM      09/07/93 22:03:18

RATE: 01.544 MB      ① .....CUSTOMER.....      LOC A: LAMRCAAVHG1  
 ISS NO: 1501      NORWALK LA MIRADA USD      LOC Z: WHTRCAXFK01  
 PATH ID: R001

ASR: 16796785      NC      NCI  
 ② ECCKT: 10FLAB100282      PRI: HCE- 04D59.15S-  
 IN-SERV: 09/03/1993      2ND: HCE- 04DU9.S---

-----DESIGNER-----  
 ACTION: ESTABLISH      MICHAEL YOUNG      CHANNELS FRAME FMT  
 STATUS: PENDING      PHONE: 909-946-0351      EQPT 01 TO 24

COMMENTS B8ZS/ESF

\*\*\*\*\*  
 STATUS      CXR LOC A      LAMRCAAV      POI

ACTION  
 LOC LAMRCAAV      EQUIPMENT UNKNOWN

CHNL 01      RTE 16598A      DESIG 01010      TYPE TIU      STATUS A  
 XMIT: CABLE 11      PAIR      196      RECV: CABLE 11      PAIR      570  
 TYPE 24

EQP: BAY 12809      SHF 11      POS 03      TYPE LIST1  
 DSX: BAY 12920      MOD 10L      PIN 03      LEVEL DS1  
 LOC WHTRCAXH

ACTION  
 LOC WHTRCAXH  
 DSX: BAY 12920      MOD 04L      PIN 13      LEVEL DS1  
 EQP: DDM-1      BAY 13121      SHF 028      POS 7      TYPE MY13

CHNL 01      RTE 6796L      DESIG 128      TYPE T2      STATUS A  
 EQP: DDM-1      BAY 22617      SHF 058      POS 7      TYPE MY13  
 DSX: BAY 22908      MOD 01R      PIN 17      LEVEL DS1  
 LOC WHTRCAXF

STATUS ACTIVE      CXR LOC Z      WHTRCAXF  
 EQP: CS1S      BAY 21921      SHF 000      POS 307      TYPE DX12  
 DSX: BAY 22916      MOD 02L      PIN 27      LEVEL DS1

FACILITY LAYOUT RECORD (FLR)

## BASIC HI-CAP MAINTENANCE

### FACILITY LAYOUT RECORD

#### **Purpose**

The Facility Layout Record (FLR) provides the information required to locate an individual circuit's equipment and facility assignments. Quick access to this information is absolutely necessary when responding to a circuit trouble report.

**NOTE:** Current plans call for the rollout of a new format for this information by 1Q94. A national standard Service Fulfillment Design System (SFDS) document will be the new source of circuit information.

#### **Key Fields**

Refer to the sample FLR as you proceed through the following chart, which describes the key fields:

FIELD NUMBER	DESCRIPTION
1	Customer Name
2	Circuit Number
3	Carrier Route
4	System Number

(continued)

# BASIC HI-CAP MAINTENANCE

CXR RTE: 16599A FACILITIES INVENTORY MANAGEMENT SYSTEM. PAGE 1 OF 1  
 DESIG: 101 \*\*\*FACILITY LAYOUT RECORD\*\*\* RPT ID: LF104530  
 TYPE: POI DERIVED FACILITY SYSTEM 09/07/93 22:03:18

5 RATE: 01.544 MB -----CUSTOMER----- LOC A: LAMRCAAVHG1  
 6 ISS NO: 1501 NORWALK LA MIRADA USD 10 LOC Z: WHTRCAXFK01  
 PATH ID: R001

7 ISSUE: 09/03/1993 ASR: 16796785 NC NCI  
 IN-SERV: 09/03/1993 ECCKT: 10FLAB100282 11 PRI: HCE- 04D59.15S-  
 2ND: HCE- 04DU9.S---

8 ACTION: ESTABLISH MICHAEL YOUNG CHANNELS FRAME FMT  
 STATUS: PENDING PHONE: 909-946-0351 EQPT 01 TO 24  
 -----DESIGNER-----

9 COMMENTS B8ZS/ESF  
 \*\*\*\*\*

STATUS CXR LOC A LAMRCAAV POI

ACTION  
 LOC LAMRCAAV EQUIPMENT UNKNOWN

12 CHNL 01 RTE 16598A DESIG 01010 TYPE TIU STATUS A  
 XMIT: CABLE 11 PAIR 196 RECV: CABLE 11 PAIR 570  
 TYPE 24

EQP: BAY 12809 SHF 11 POS 03 TYPE LIST1  
 DSX: BAY 12920 MOD 10L PIN 03 LEVEL DS1  
 LOC WHTRCAXH

ACTION  
 LOC WHTRCAXH  
 DSX: BAY 12920 MOD 04L PIN 13 LEVEL DS1  
 EQP: DDM-1 BAY 13121 SHF 028 POS 7 TYPE MY13

CHNL 01 RTE 6796L DESIG 128 TYPE T2 STATUS A  
 EQP: DDM-1 BAY 22617 SHF 058 POS 7 TYPE MY13  
 DSX: BAY 22908 MOD 01R PIN 17 LEVEL DS1  
 LOC WHTRCAXF

STATUS ACTIVE CXR LOC Z WHTRCAXF

EQP: CS1S BAY 21921 SHF 000 POS 307 TYPE DX12  
 DSX: BAY 22916 MOD 02L PIN 27 LEVEL DS1

## FACILITY LAYOUT RECORD (FLR)

## BASIC HI-CAP MAINTENANCE

### FACILITY LAYOUT RECORD, continued

#### **Key Fields, continued**

FIELD NUMBER	DESCRIPTION
5	User Type: <ul style="list-style-type: none"><li>• POI Point of Interface</li><li>• ST Switch Termination</li><li>• NT4 NTI D4 Channel Bank</li><li>• T1HCDZ B8ZS Line Code</li><li>• T1HCDS AMI Line Code</li></ul>
6	FLR Issue Number
7	In-Service Date
8	Action to be performed
9	Comments/Remarks
10	CLLI Codes for Locations A & Z (Common Language Location Identifier)
11	NC = Network Channel code defines the transmission performance ordered  NCI = Network Channel Interface identifies the electrical conditions at the customer interface
12	Span Facility Assignment

(continued)

## BASIC HI-CAP MAINTENANCE

```

CXR RTE: 16599A      FACILITIES INVENTORY MANAGEMENT SYSTEM  PAGE 1 OF 1
DESIG: 101          ***FACILITY LAYOUT RECORD***      RPT ID: LF104530
TYPE: POI           DERIVED FACILITY SYSTEM           09/07/93 22:03:18

RATE: 01,544 MB      -----CUSTOMER-----      LOC A: LAMRCAAVHG1
ISS NO: 1501         NORWALK LA MIRADA USD          LOC Z: WHTRCAXFK01
PATH ID: R001

ASR: 16796785      NC NCI
EQUJKT: 10FLAB100282  PRI: HCE- 04D59.15S-
ISSUE: 09/03/1993  2ND: HCE- 04DU9.S-
IN-SERV: 09/03/1993

```

		-----DESIGNER-----		
ACTION:	ESTABLISH	MICHAEL YOUNG	CHANNELS FRAME FMT	
STATUS:	PENDING	PHONE: 909-946-0351	EQPT 01 TO 24	

COMMENTS B8ZS/ESF

```

STATUS                CXR LOC A      LAMRCAAV      POI
. . . . .
ACTION
  LOC LAMRCAAV        EQUIPMENT UNKNOWN
    (13)              (14)              (15)              (16)
  CHNL 01             RTE 16598A        DESIG 01010      TYPE TIU      STATUS A
  XMIT: CABLE 11     PAIR 196          RECV: CABLE 11     PAIR 570
  TYPE 24              (17)              (18)

```

19	EQP:	BAY 12809	SHF 11	POS 03	TYPE LIST1 LEVEL DS1
20	DSX:	BAY 12920	MOD 10L	PIN 03	

LOC WHTRCAXH

ACTION

LOC WHTRCAXH

20	DSX:	BAY 12920	MOD 04L	PIN 13	LEVEL DS1
19	EQP: DDM-1	BAY 13121	SHF 028	POS 7	TYPE MY13
13	CHNL 01	RTE 6796L	DESIG 128	TYPE T2	STATUS A
14	EQP: DDM-1	BAY 22617	SHF 058	POS 7	TYPE MY13
15	DSX:	BAY 22908	MOD 01R	PIN 17	LEVEL DS1

LOC WHTRCAXF

STATUS ACTIVE	CXR LOC Z	WHTRCAXF			
EQP: CS1S	BAY 21921	SHF 000	POS 307	TYPE DX12	
DSX:	BAY 22916	MOD 02L	PIN 27	LEVEL DS1	

## FACILITY LAYOUT RECORD (FLR)

## BASIC HI-CAP MAINTENANCE

### FACILITY LAYOUT RECORD, continued

#### **Key Fields, continued**

FIELD NUMBER	DESCRIPTION
13	Channel
14	Route
15	System Designation
16	Type (hierarchy)
17	Transmit Cable and Pair Number (to the customer)
18	Receive Cable and Pair Number (from the customer)
19	Office Span Equipment: <ul style="list-style-type: none"><li>• Bay</li><li>• Shelf</li><li>• Position</li><li>• Type</li></ul>
20	Office DSX Location: <ul style="list-style-type: none"><li>• Bay</li><li>• Mod (left or right)</li><li>• Pin (jack number)</li></ul>

## BASIC HI-CAP MAINTENANCE

### NOTES

CIRCUIT

*Introdu*

## **BASIC HI-CAP MAINTENANCE**

### **CIRCUIT LAYOUT RECORD**

#### ***Introduction***

The Circuit Layout Record (CLR) provides the information required to locate an individual circuit's equipment and facility assignments. CLR may consist of one to several pages depending on circuit design. See the sample CLR on pages 36-37 and field descriptions on pages 38-43.

(continued)

# BASIC HI-CAP MAINTENANCE

THIS CIRCUIT LISTING WAS PRODUCED ON 10/11/93 AT 15:42:36

(Page 1 of 2)

SPECIAL SERVICE (SERIAL NO.) LISTING

(PENDING ADD)

② PFX SER CD SER NO SUFX CO ASG SEG LOCATON A PLSG LOCATION Z DESIGN CA  
12 HC GS 200999 CTEC IRNGTX021MD -- IRNGTXBBH03 S A

① CUSTOMER NAME CUST ID PRIOR CKT ORDER #  
MICROSOFT PSS - LAS COLI MCI CGC2021279999

TEST LP RES SWS SWA \*\* CONTROL \*\*  
FREQ CUR EML ICL A Z A Z LOCATION TELEPHONE ASSOC ORDER #  
.0 .0 SSCCTXXB 2145551150

A NOISE Z ERL SRL RL A TYSG Z IMP NOISE NET/PLT CTL BCIA SVC TST CTR LENGTH  
-- 27 / 29 SSCCTXXA

EML SL USO CODE

OPR SPEED

③ PON IZ2490291VG00888 ④ DUE DTE TST DTE  
082493 081693

STE ENG RTE USE EQV M M RCV CKT CMPL CDS DHR PREPARED BY  
CD CTL CO CD MI MI L COND O OPR CLASS ISS DATE REQ RFD FLD INIT TELEPHONE  
E WA NONE 03 00 JMS 2142567084

\*\*\*\*\* CIRCUIT COMMENTS \*\*\*\*\*

1 2 3 4 5  
PLEASE INSTALL T-1 ON DESIRED DUE DATE., PLEASE PROVIDE INSIDE WIRING IF NE

⑤ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭

⑥ LOCATION EQUIPMENT ID BAY/RR SHELF POS# SV A TLP  
LID T N ROUTE DESIG TYPE PR-CH FG DV A SIG Z SGAR  
CKR: NP08176100019991 CUST CD:  
NC: HC NCI: 04DS6.44 . SEC NCI: 04DU9.BN .

001 X PON IZ2490291VG00888 BC DR MISC ACTN  
010 X ADDRESS 2221 REID AVE., IRVING, TX BC DR MISC CKL-001 ACTN  
020 X CUSTPREM 3110 LOOPBACK UNIT BC DR MISC WESTELL ACTN  
030 L IRNGTXGDSO CA-105 196 BC DR MISC T ACTN  
⑬ 040 L IRNGTXGDSO CA-105 570 BC DR MISC R ACTN  
050 X IRNGTXGDSO MISC NOTES FOR TRAINING MA BC 00 DR MISC ACTN  
⑭ 051 T IRNGTXGDSO DSXJK TCR319 SH-N 0017 BC 00 DR MISC ACTN  
060 X IRNGTXGDSO CROSS CONNECTS BC 00 DR MISC 102T3-T1 ACTN  
061 T IRNGTXGDSO DSXJK TCR318 SH-U 0052 BC 00 DR MISC ACTN  
070 D 5434A 103T3 T3 24 MA BC 00 DR MISC ACTN  
080 T IRNGTXMO481 694-4186-001 REM703 SH-2 0024 MA BC 00 DR MISC ACTN  
090 C 5672 G501 22NL 73

CIRCUIT LAYOUT RECORD

Page 1 of 2

# BASIC HI-CAP MAINTENANCE

SPECIAL SERVICE (SERIAL NO.) LISTING (PENDING ADD) (Page 2 of 2)

PFX	SRV	CD	SER NO	SUF	CO	ASG	SEG	LOCATON A	PLSG	LOCATION Z	DESIGN CA
12	HC	GS	200999			GTEC		IRNGTX021MD	--	IRNGTXBBH03	S A

	LOCATION	EQUIPMENT ID	BAY/RR	SHELFPOS#	SVA	TLP
Z	LID T N ROUTE	DESIG TYPE	PR-CH	FG	DVA SIG Z	SGAR

100 C	5672	G501 22NL	173			
		MA	BC 00	DR	MISC	ACTN
110 X	IRNGTXBBH03	MICROSOFT-PSS LAS COLI				
		MA	BC 00	DR	MISC	ACTN
120 X		SMART LOOPBACK JACK				
			BC 00	DR	MISC	ACTN
130 P	CUSTPREM	RJ48X				
			BC 00	DR	MISC	4
140 X		JS=N			MISC	04DU9.BN.
			BC 00	DR	MISC	4
150 X	ADDRESS	1212 CORPORATE DR, IRVING, TX				
			BC 00	DR	MISC	CKL-003
160 X	LOC	FLR 1ST;RM TELCO				
			BC 00	DR	MISC	ACTN
170 X	LOCCN	JANE SMITH	214 555-1212			
			BC 00	DR	MISC	ACTN
180 X	*****	*****				
			BC 00	DR	MISC	ACTN
190 X	ISSUE 1:	START HI-CAP FOR MICROSOFT PSS-LABS				
			BC 00	DR	MISC	ACTN
200 X		COLI TO MCI, NO TER REQUIRED.				
			BC 00	DR	MISC	ACTN
210 X	*****	*****				
			BC 00	DR	MISC	ACTN
220 X	ISSUE 2:	SUPP TO CHANGE DD TO 8-19-93				
			BC 00	DR	MISC	ACTN
230 X		EXPEDITE DATE.				
			BC 00	DR	MISC	ACTN
240 X	*****	*****				
			BC 00	DR	MISC	ACTN
250 X	CRCCTXZZ					
			BC 00	DR	MISC	ACTN
260 X	IMP CONT	TECH ON DUTY 214 555-1213				
			BC 00	DR	MISC	ACTN
998 X	aces	CLRD 082593 WOT 081293				
			BC 00	DR	MISC	ACTN

CIRCUIT LISTING COMPLETE

## CIRCUIT LAYOUT RECORD

Page 2 of 2

# BASIC HI-CAP MAINTENANCE

THIS CIRCUIT LISTING WAS PRODUCED ON 10/11/93 AT 15:42:36

(Page 1 of 2)

SPECIAL SERVICE (SERIAL NO.) LISTING

(PENDING ADD)

②	PPX SRV CD	SER NO	SUFY	CO ASG	SEG	LOCATON A	PLSG	LOCATION Z	DESIGN CA
	12 HC	GS 200999		GTEC		IRNGTX021MD	--	IRNGTXBBH03	S A

①	CUSTOMER NAME MICROSOFT PSS - LAS COLI	CUST ID MCI	PRIOR	CKT ORDER # CGC2021279999
---	---	----------------	-------	------------------------------

TEST LP RES	SWS	SWA	* * CONTROL * *
FREQ CUR EML ICL A Z A Z	LOCATION	TELEPHONE	ASSOC ORDER #
.0 .0	SSCCTXXB	2145551150	

A NOISE Z ERL SRL RL A TVSG Z IMP NOISE NET/PLT CTL ECIA SVC TST CTR LENGTH  
27 / 29 SSCCTXXA

EML SL USO CODE	OPR SPEED	PON	DUE DTE TST DTE
		IZZ249029IVG00888	082493 081693

STE ENG	RTE USE	EQV M	M RCV	CKT	CMPL	CDS	DHR	PREPARED BY
CD CTL CO CD MI MI L COND O	OPR CLASS	ISS DATE	REQ RED	FLD INIT	TELEPHONE			
E WA	NONE	03	00	JMS	2142567084			

\* \* \* \* \* CIRCUIT COMMENTS \* \* \* \* \*

1 2 3 4 5  
PLEASE INSTALL T-1 ON DESIRED DUE DATE., PLEASE PROVIDE INSIDE WIRING IF NE

LID	T N	LOCATION	EQUIPMENT ID	BAY/RR	SHELF	POS#	SV	A TLP Z
		ROUTE	DESIG TYPE	PR-CH FG DV				
		CKR: NP08176100019991						
		NC: HC	NCI: 04DS6.44					
001	X	PON	IZZ249029IVG00888					
			BC	DR			MISC	ACTN
010	X	ADDRESS	2221 REID AVE., IRVING, TX					
			BC	DR			MISC CXL-001	ACTN
020	X	CUSTPREM	3110 LOOPBACK UNIT				4	
			BC	DR			MISC WESTELL	ACTN
030	L	IRNGTXGDSO CA-105	196				T	
			BC	DR			MISC	ACTN
040	L	IRNGTXGDSO CA-105	570				R	
		MA	BC 00	DR			MISC	ACTN
050	X	IRNGTXGSD	MISC NOTES FOR TRAINING					
		MA	BC 00	DR			MISC	ACTN
051	T	IRNGTXGDSO DSXJK		TCR319	SH-N	0017		
			BC 00	DR			MISC	ACTN
060	X	IRNGTXGSD	CROSS CONNECTS					
			BC 00	DR			MISC 102T3-T1	ACTN
061	T	IRNGTXGDSO DSXJK		TCR318	SH-U	0052		
			BC 00	DR			MISC	ACTN
070	D	5434A 103T3 T3	24					
		MA	BC 00	DR			MISC	ACTN
080	T	IRNGTXMO481 694-4186-001		REM703	SH-2	0024		
		HW	MA	BC 00			MISC	ACTN
090	C	5672 G501 22NL	73					

## CIRCUIT LAYOUT RECORD

# BASIC HI-CAP MAINTENANCE

## CIRCUIT LAYOUT RECORD, continued

### **Key Fields**

In all Areas (except California) the Circuit Network Administration System (CNAS) generates the detailed circuit assignment information for the technicians.

**NOTE:** Current plans call for the rollout of a new format for this information in 1Q94. A national standard Service Fulfillment Design System (SFDS) document will be the new source of circuit information.

Refer to the sample CLR as you proceed through the following chart, which describes the key fields:

FIELD NUMBER	DESCRIPTION																								
1	Customer Name																								
2	Circuit Number listing follows the "Serial Number Format" and consists of:																								
	<table><tr><td>Prefix</td><td>Service Code Modifier</td><td>Serial Number</td><td>Suffix</td><td>Co. Assigning ID</td><td>Segment Number</td></tr><tr><td>XX</td><td>XXXX</td><td>XXXXXXXX</td><td>XXX</td><td>XXX</td><td>XXX</td></tr><tr><td></td><td>Location A</td><td></td><td>Pulsing</td><td></td><td>Location Z</td></tr><tr><td></td><td>XXXXXXXXXXXX</td><td>XX</td><td>XXXXXXXXXXXX</td><td></td><td></td></tr></table>	Prefix	Service Code Modifier	Serial Number	Suffix	Co. Assigning ID	Segment Number	XX	XXXX	XXXXXXXX	XXX	XXX	XXX		Location A		Pulsing		Location Z		XXXXXXXXXXXX	XX	XXXXXXXXXXXX		
Prefix	Service Code Modifier	Serial Number	Suffix	Co. Assigning ID	Segment Number																				
XX	XXXX	XXXXXXXX	XXX	XXX	XXX																				
	Location A		Pulsing		Location Z																				
	XXXXXXXXXXXX	XX	XXXXXXXXXXXX																						

(continued)

# BASIC HI-CAP MAINTENANCE

THIS CIRCUIT LISTING WAS PRODUCED ON 10/11/93 AT 15:42:36

(Page 1 of 2)

SPECIAL SERVICE (SERIAL NO.) LISTING (PENDING ADD)

PPX SRV CD SER NO SUFX CO ASG SEG LOCATON A PLSG LOCATION Z DESIGN CA  
12 HC GS 200999 GTEC IRNGTX021MD -- IRNGTXBBH03 S A

CUSTOMER NAME MICROSOFT PSS - LAS COLI CUST ID MCI PRIOR CKT ORDER # CGC2021279999

TEST LP RES SWS SWA \* \* CONTROL \* \*  
FREQ CUR EML ICL A Z A Z LOCATION TELEPHONE ASSOC ORDER #  
.0 .0 SSCCTXXB 2145551150

A NOISE Z ERL SRL RL A TYSG Z IMP NOISE NET/PLT CTL ECIA SVC TST CTR LENGTH  
-- 27 / 29 SSCCTXXA

EML SL USO CODE OPR SPEED ③ PON IZ249029IVG00888 ④ DUE DTE TST DTE 082493 081693

STE ENG RTE USE EQV M M RCV CKT CMPL CDS DHR PREPARED BY  
CD CTL CO CD MI MI L COND 0 OPR CLASS ISS DATE REQ RFD FLD INIT TELEPHONE  
E WA NONE 03 00 JMS 2142567084  
\* \* \* \* \* CIRCUIT COMMENTS \* \* \* \* \*

1 2 3 4 5  
PLEASE INSTALL T-1 ON DESIRED DUE DATE., PLEASE PROVIDE INSIDE WIRING IF NE

⑤ ⑦  
⑥ LOCATION EQUIPMENT ID BAY/RR SHELF POS# SV A TLP Z  
LID T N ROUTE DESIG TYPE PR-CH FG DV A SIG Z SGAR  
CCR: NP08176100019991  
NC: HC NCI: 04DS6.44 . CUST CD: SEC NCI: 04DU9.BN .

001	X	PON	IZ249029IVG00888	BC	DR	MISC	ACTN
010	X	ADDRESS	2221 REID AVE., IRVING, TX	BC	DR	MISC CKL-001	ACTN
020	X	CUSTPREM	3110 LOOPBACK UNIT	BC	DR	MISC WESTELL	ACTN
030	L	IRNGTXXGDSO	CA-105	196	DR	MISC	ACTN
040	L	IRNGTXXGDSO	CA-105	570	DR	MISC	ACTN
050	X	IRNGTXXGD	MISC NOTES FOR TRAINING	MA BC 00	DR	MISC	ACTN
051	T	IRNGTXXGDSO	DSXJK	BC 00	DR	SH-N 0017	ACTN
060	X	IRNGTXXGD	CROSS CONNECTS	BC 00	DR	MISC 102T3-T1	ACTN
061	T	IRNGTXXGDSO	DSXJK	BC 00	DR	SH-U 0052	ACTN
070	D	5434A	103T3 T3	24	DR	MISC	ACTN
080	T	IRNGTXMO481	694-4186-001	MA BC 00	DR	SH-2 0024	ACTN
090	C	5672	G501 22NL	73			

## CIRCUIT LAYOUT RECORD

## BASIC HI-CAP MAINTENANCE

### CIRCUIT LAYOUT RECORD, continued

#### **Key Fields, continued**

FIELD NUMBER	DESCRIPTION
3	Purchase Order Number (PON) is commonly used by the connecting telco to identify the circuit since CKT IDs may be different.
4	Critical dates (Due and Plant Test Date)
5	Line identifier column that number automatically increments.
6	Line Type column:  B = Foreign-owned equipment C = Interexchange cable and pairs D = Derived facility (GTE-owned) F = Foreign-owned facility G = Plug-in equipment (inventoried equipment) L = Local loop cable and pair (to the customer) P = Equipment at the customer's premises T = Equipment assignment line X = Miscellaneous information
7	Location and Route column

(continued)

# BASIC HI-CAP MAINTENANCE

THIS CIRCUIT LISTING WAS PRODUCED ON 10/11/93 AT 15:42:36

(Page 1 of 2)

SPECIAL SERVICE (SERIAL NO.) LISTING (PENDING ADD)

PFX SRV CD SER NO SUFX CO ASG SEC LOCATON A PLSG LOCATION Z DESIGN CA  
12 HC GS 200999 GTEC IRNGTX021MD .. IRNGTXBBH03 S A

CUSTOMER NAME MICROSOFT PSS - LAS COLI CUST ID MCI PRIOR CKT ORDER # CGC2021279999

TEST LP RES SWS SWA \* \* CONTROL \* \*  
FREQ CUR EML ICL A Z A Z LOCATION TELEPHONE ASSOC ORDER #  
.0 .0 SSCCTXXB 2145551150

A NOISE Z ERL SRL RL A TYSG Z IMP NOISE NET/PLT CTL ECIA SVC TST CTR LENGTH  
.. 27 / 29 SSCCTXXA

EML SL USO CODE OPR SPEED PON DUE DTE TST DTE  
I2249029IVG00888 082493 081693

STE ENG RTE USE EQV M M RCV CKT CMPL CDS DHR PREPARED BY  
CD CTL CO CD MI MI L COND O OPR CLASS ISS DATE REQ RFD FLD INIT TELEPHONE  
E WA NONE 03 00 JMS 2142567084

\* \* \* \* \* CIRCUIT COMMENTS \* \* \* \* \*

1 2 3 4 5  
PLEASE INSTALL T-1 ON DESIRED DUE DATE., PLEASE PROVIDE INSIDE WIRING IF NE

(8) (9) (10) (11) (12) (13) (14)

LOCATION	EQUIPMENT ID	BAY/RR	SHELF	POS#	SV	A	TLP	Z
LID T N ROUTE	DESIG TYPE PR-CH PG DV		A SIG Z SGAR					
CKR: NP08176100019991		CUST CD:						
NC: HC	NCI: 04DS6.44	SEC NCI: 04DU9.BN						

001 X	PON	I2249029IVG00888	BC	DR	MISC	ACTN
010 X	ADDRESS	2221 REID AVE., IRVING, TX	BC	DR	MISC CKL-001	ACTN
020 X	CUSTPREM	3110 LOOPBACK UNIT	BC	DR	MISC WESTELL	ACTN
030 L	IRNGTXGDSO CA-105	196	BC	DR	MISC	ACTN
(16) 040 L	IRNGTXGDSO CA-105	570	MA	BC 00	DR	MISC
050 X	IRNGTXGDSO	MISC NOTES FOR TRAINING	MA	BC 00	DR	MISC
(17) 051 T	IRNGTXGDSO DSXJK	TCR319	SH-N	0017		ACTN
060 X	IRNGTXGDSO	CROSS CONNECTS	BC 00	DR	MISC 102T3-T1	ACTN
061 T	IRNGTXGDSO DSXJK	TCR318	SH-U	0052		ACTN
070 D	5434A	103T3 T3	24			
		MA	BC 00	DR	MISC	ACTN
080 T	IRNGTXMO481	694-4186-001	REM703	SH-2	0024	ACTN
	HW	MA	BC 00	DR	MISC	
090 C	5672	G501 22NL	73			

## CIRCUIT LAYOUT RECORD

# BASIC HI-CAP MAINTENANCE

## CIRCUIT LAYOUT RECORD, continued

### **Key Fields, continued**

FIELD NUMBER	DESCRIPTION
8	Equipment ID or Designation Type column
9	Pair or Channel assignment column
10	Bay or Relay Rack column
11	Shelf number/designation column
12	Position of equipment within the shelf
13	Signal/Voice-coded column:  <div style="margin-left: 40px;"> T = Transmit path  R = Receive path  * = Undefined </div>
14	Transmission Level Point (TLP) does <b>not</b> apply to Hi-Cap service.
15	Network Channel (NC) and Network Channel Interface (NCI) codes describe the circuit test and interface requirements. Refer to the <u>Technical Interface Reference Manual</u> for additional detail.
16	A sample <i>local</i> Cable and Pair assignment line
17	A sample DSX assignment line

## BASIC HI-CAP MAINTENANCE

### DS1 SIGNAL CHARACTERISTICS

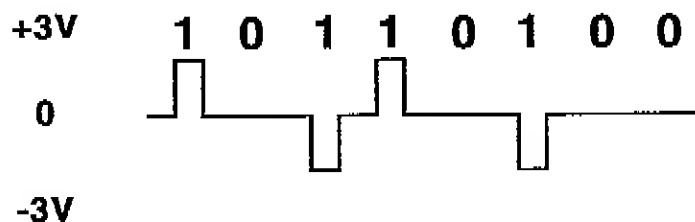
#### ***Line Coding***

Line coding is a process where the customer's data signal, pulses representing bits 0 & 1, is converted to a format acceptable for transmission over copper facilities. This is accomplished by changing data from the CPE from a unipolar format to a bipolar format. The standard signal format used over cable facilities is an alternating positive and negative 2.4 to 3.6 volt pulse.

#### **Alternate Mark Inversion**

Alternate Mark Inversion (AMI), commonly referred to as Bipolar pulses, inverts the polarity of consecutive 1s bits. AMI format allows a simple means of error detection known as the Bipolar Violation (BPV).

### **Bipolar/AMI**



(continued)

## BASIC HI-CAP MAINTENANCE

### DS1 SIGNAL CHARACTERISTICS, continued

#### *Line Coding, continued*

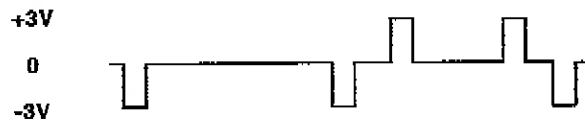
#### Bipolar 8-Bit Zero Substitution

Bipolar 8-Bit Zero Substitution (B8ZS) is a signaling technique used to provide ones pulses in the event of 8 consecutive zeros of data from the customer equipment. A minimum of one pulse in eight is required by the network span repeaters. B8ZS inserts intentional BPVs to represent a string of 8 consecutive zeros.

**NOTE:** A good B8ZS signal may indicate BPV errors on some DS1 test equipment or error LEDs on OTRs.

#### **B8ZS**

Bit Positions	1	2	3	4	5	6	7	8
Data Sent	1	0	0	0	0	0	0	0



(continued)

## **BASIC HI-CAP MAINTENANCE**

### **NOTES**

## BASIC HI-CAP MAINTENANCE

### DS1 SIGNAL CHARACTERISTICS, continued

#### **Frame Formats**

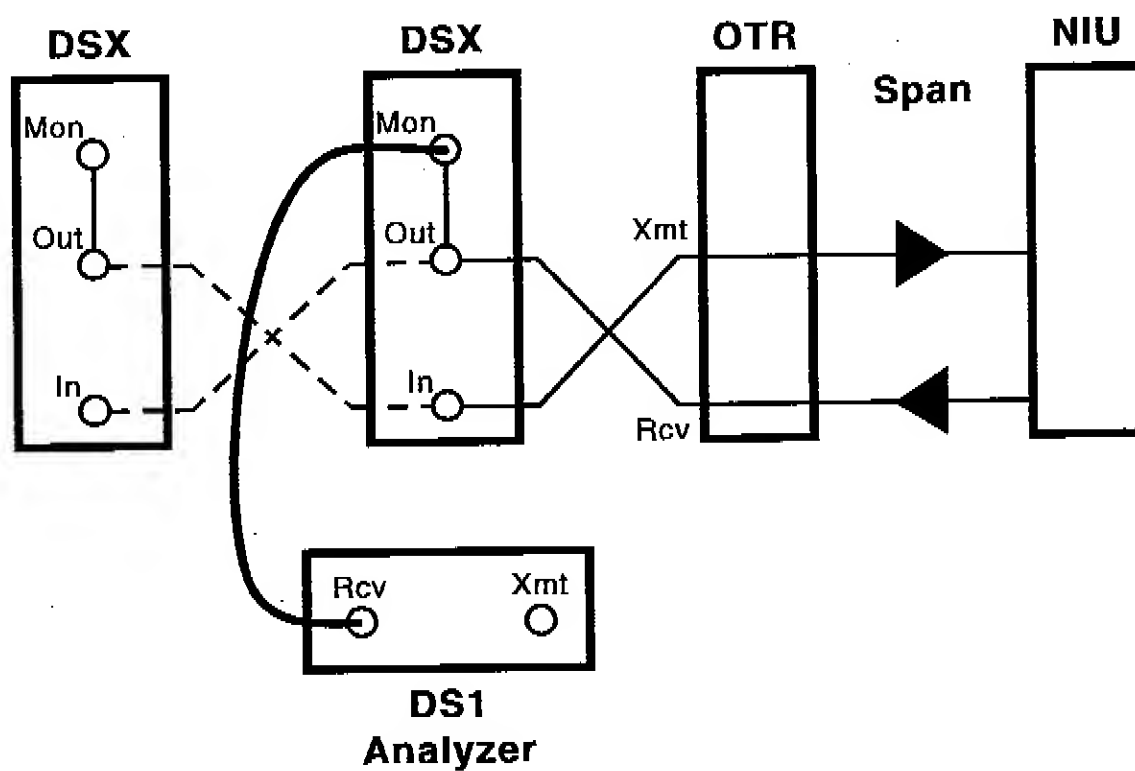
The DS1 signal is arranged in frames of 193 bits, 8,000 times per second, for a total of 1,544,000 b/s or 1.544 Mb/s.

Each frame contains one frame bit and 192 information/signal bits. Briefly, the DS1 frame formats are described in the following chart:

FRAME FORMAT	DESCRIPTION
Super Frame (SF)	More commonly known as D4 channel bank signal, it consists of 12 consecutive DS1 frames. The framing bits are used for synchronization only.
Extended Super Frame (ESF)	<p>Twenty-four consecutive DS1 frames where the framing bits are used for more than just synchronization.</p> <p>The key benefit of ESF is something known as a Cyclic Redundancy Check (CRC). Stated simply, CRC allows an advanced means of error checking for the signal. CRC errors mean incorrect data is being received by the customer.</p>
Unframed	<ul style="list-style-type: none"><li>• Nonstandard DS1 signal format.</li><li>• Generated by some CPE.</li><li>• Will indicate a good T1 signal without frame sync on a DS1 analyzer.</li></ul>

**NOTE:** DS1 or T1 signal analyzer test sets will indicate the frame format and line code type.

## BASIC HI-CAP MAINTENANCE



IN-SERVICE MONITOR

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS

#### ***In-Service Testing***

In-service testing:

- Is also referred to as "Non-Intrusive" testing.
- Is performed with a DS1 analyzer.
- Is the only DS1 testing performed on a Hi-Cap unless the customer authorizes intrusive testing.
- Is normally performed at the DSX panel.
- Does **not** interrupt a customer's circuit.
- Monitors the circuit condition and indicates:
  - A variety errors, if present.
  - Signal format and line coding.
  - Signal strength.

Normal circuit conditions at the DSX Monitor jack using the T-209A are:

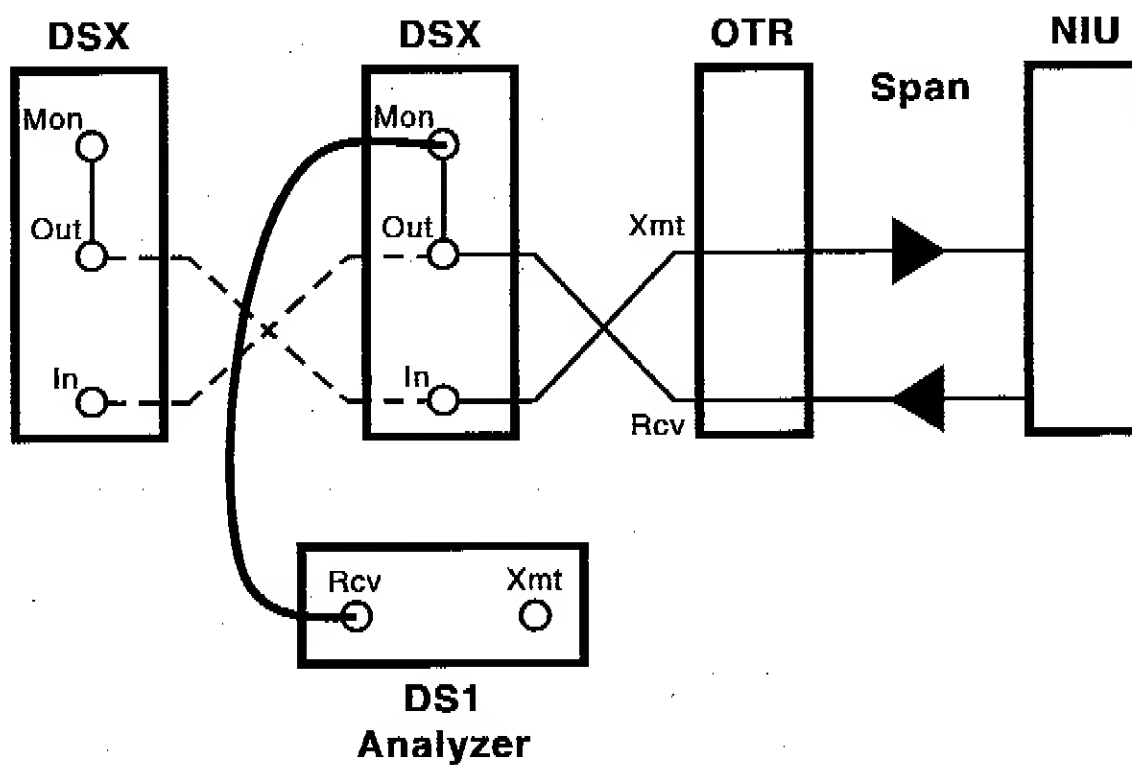
- ALL RESULTS OK displayed.
- T1 PULSES.
- FRAME SYNC.

**NOTE:** The red pulse shape LED will illuminate on a monitor test. Ignore this alarm indication.

---

(continued)

## BASIC HI-CAP MAINTENANCE



IN-SERVICE MONITOR

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS, continued

#### ***In-Service Testing, continued***

---

Abnormal indications (any red lights) *must* be communicated to the CRCC:

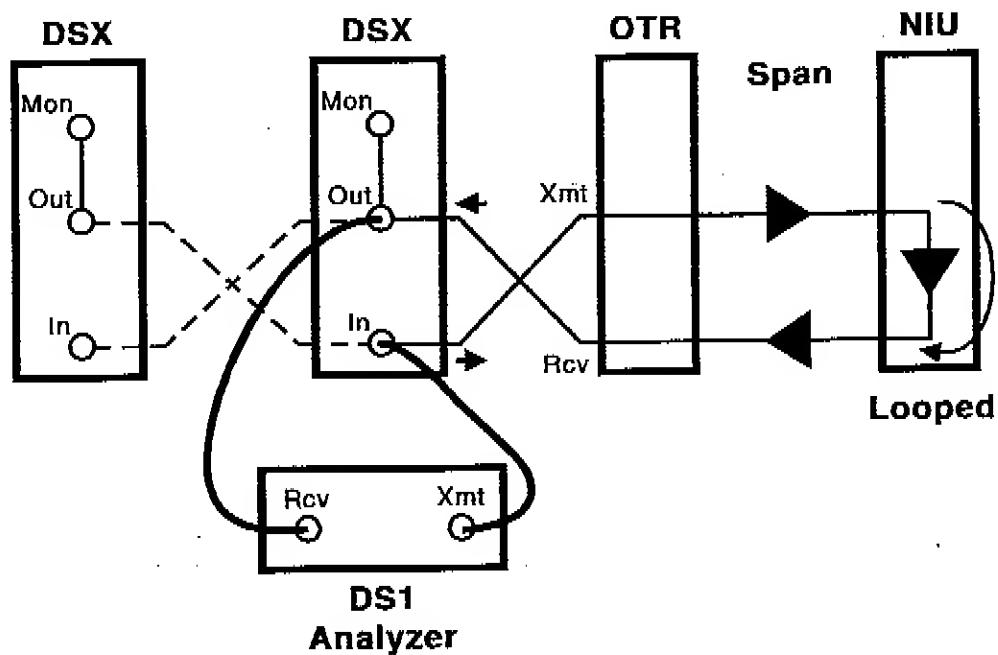
- Signal Loss indicates there is no PCM on this section of the circuit, which may be due to a network fault or absence of customer transmission.
- Frame Loss.
- Ones Density.
- Excess Zeros.
- Yellow Alarm.
- All Ones.
- BPV (window display).

**NOTE:** See the Appendix for additional information on trouble indications.

---

(continued)

## BASIC HI-CAP MAINTENANCE



## OUT-OF-SERVICE TESTING

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS, continued

#### **Out-of-Service Testing**

#### **Description**

Out-of-Service testing is also referred to as "intrusive" testing. This type of testing *will* take the customer's circuit down, which allows an accurate assessment of the circuit by transmitting and receiving test patterns in place of the customer's live data using a DS1 analyzer such as the T-BERD 209A.

**WARNING:** The customer *must* authorize intrusive tests. Do **not** attempt this type of testing without proper authorization.

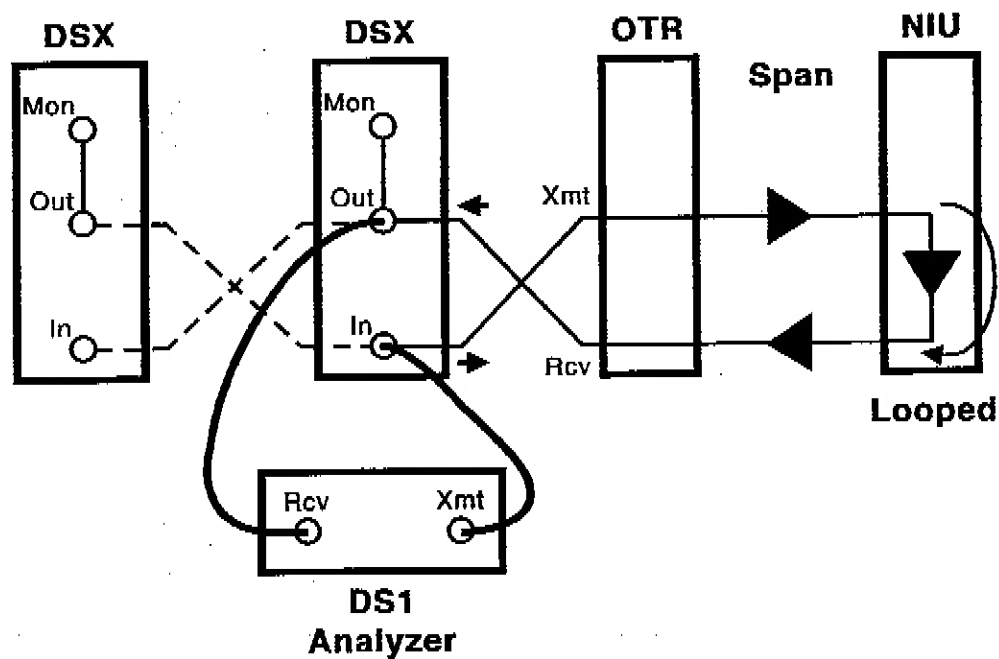
#### **Test Methods**

Two test methods used are:

METHOD	EXPLANATION
Point-to-Point	Requires two technicians, one at each end of the facility to be tested, equipped with like test equipment
Loopback	Is performed by a single technician at the C.O. testing the transmit and receive of the circuit toward one customer location: <ul style="list-style-type: none"><li>- Insert test equipment into the circuit.</li><li>- Send NIU loop-up code to the customer's premises (specific code recognized only by NIU).</li><li>- Apply test patterns to the circuit.</li><li>- Receive and analyze test patterns.</li></ul>

(continued)

## BASIC HI-CAP MAINTENANCE



OUT-OF-SERVICE TESTING

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS, continued

#### ***Out-of-Service Testing, continued***

#### **Test Patterns**

Test patterns commonly used in out-of-service testing are:

PATTERN	DESCRIPTION
3 in 24	A 1s and 0s density stress test of span line repeaters  <b>NOTE:</b> This pattern causes an Excess Zeros alarm LED. Ignore this indication.
QRSS	Quasi Random Signal Source - a predefined pattern of 1s and 0s that tests a combination of repetitive bits
All Ones	A stress test for span repeaters  <b>NOTE:</b> This pattern causes an Excess Ones alarm LED. Ignore this indication.
Bridge Tap	A combination of test patterns used to detect cable bridge taps

**NOTE:** See the Appendix for additional information on test patterns and results.

Test results are reported to the CRCC by the C.O. Technician.

(continued)

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS, continued

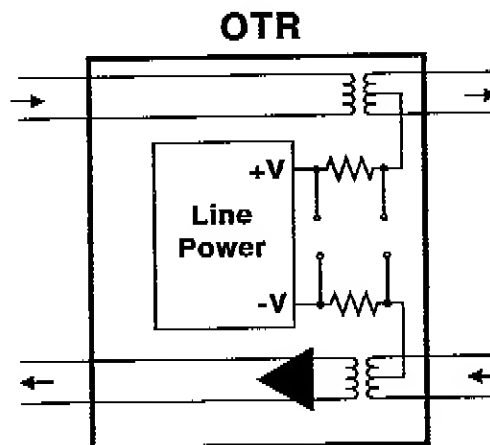
#### **Span Power Tests**

The correct span power tests and results interpretation is a key factor in Hi-Cap trouble isolation. Span current measurements are made at the OTR to verify proper current, as required by the field repeaters and/or NIU. Two types of powering tests are available: span line powering and simplex powering.

#### **Span Line Powering**

Span line powering includes the following OTR functions:

- Terminates the transmit (XMT) and receive (RCV) cable pairs
- Regenerates the RCV signal from the span
- Provides test access points for voltage and current measurements
- Provides regulated DC simplex current to field repeaters and NIU

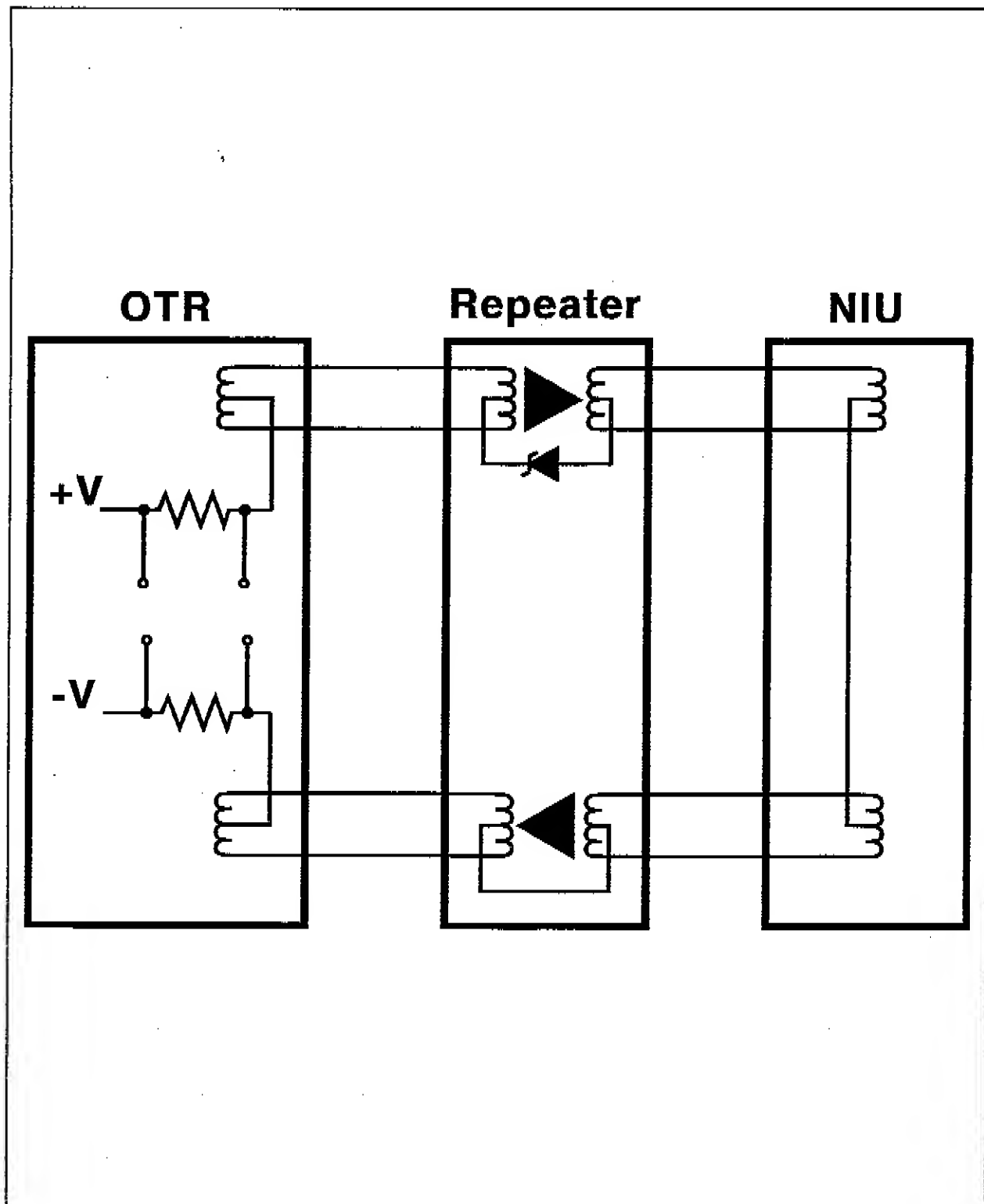


(continued)

## **BASIC HI-CAP MAINTENANCE**

### ***NOTES***

## BASIC HI-CAP MAINTENANCE



SIMPLEX POWER

## **BASIC HI-CAP MAINTENANCE**

### **TEST METHODS AND ACCESS, continued**

#### ***Span Power Tests, continued***

#### **Simplex Powering**

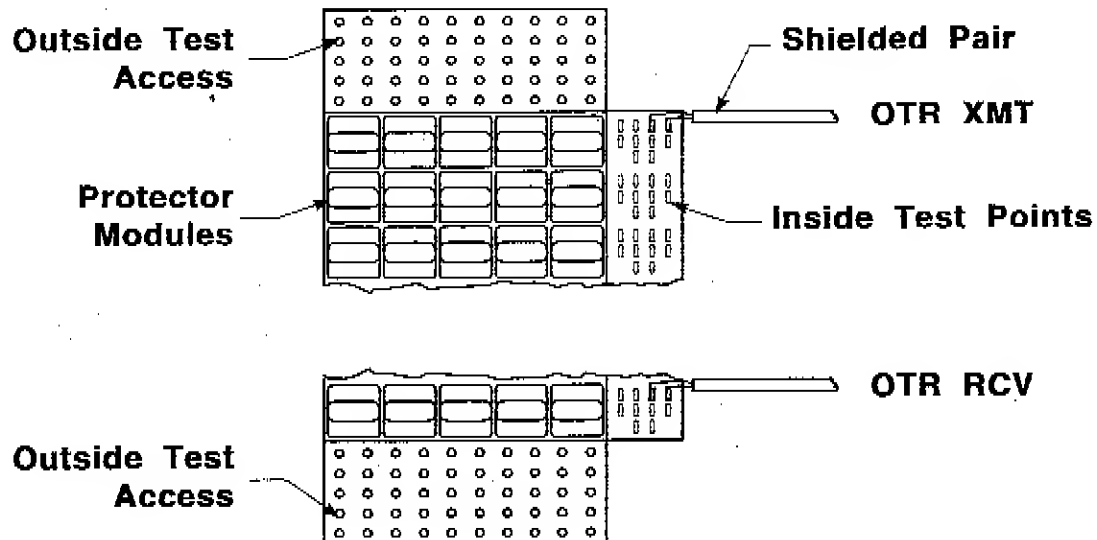
Simplex power fundamentals are as follows:

- Power regulator.
- Provides a negative potential through a series resistor to the center tap of a simplex transformer. Negative potential is applied to both tip and ring equally.
- Power is looped at the NIU to the transmit pair via the center taps of the simplex transformers.
- Positive potential on both the tip and ring of the transmit pair.

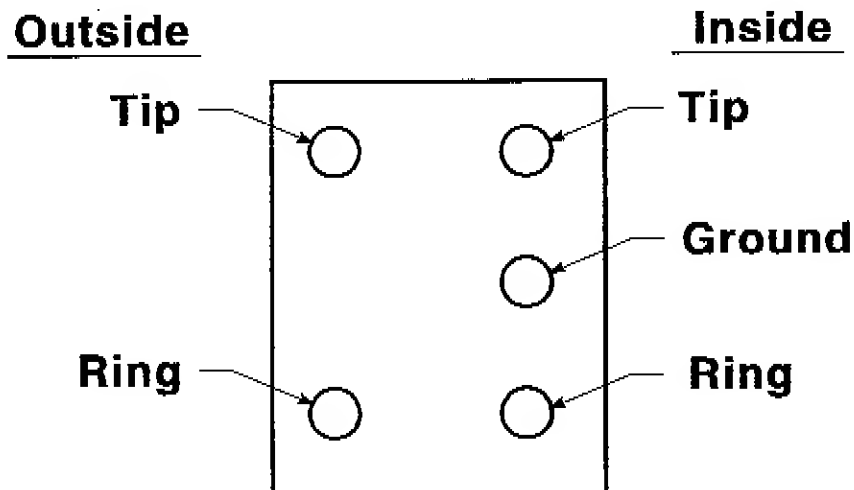
---

(continued)

## BASIC HI-CAP MAINTENANCE



### Protector Block Pins



MAIN DISTRIBUTION FRAME (TYPE 303)

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS, continued

#### **Frame Test Access**

The C.O. main frame is a key point of proving span troubles in or out of the C.O. History shows this to be a prime candidate for trouble sources such as:

- Bad modules.
- Broken cross-connects.
- Shorts or crosses on the pins (wire clippings).
- Maintenance technicians shorting unprotected pins while checking adjacent pairs.

The illustration on page 60 shows the standard frame layout:

- Vertical side of the MDF
- Inside and outside test access points
- Jumper connection pins located on the protector mounting block

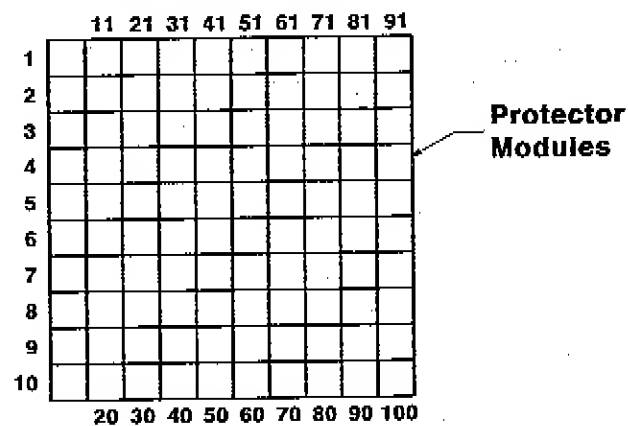
**NOTE:** Some MDFs allow easy access to outside cable termination pins.

---

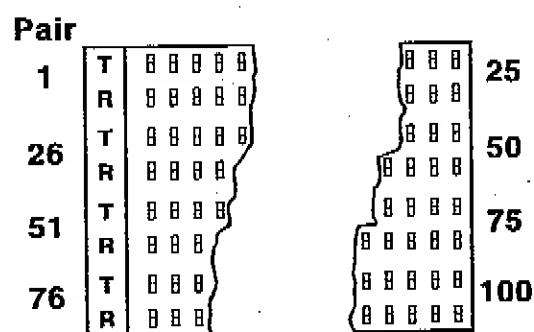
(continued)

# BASIC HI-CAP MAINTENANCE

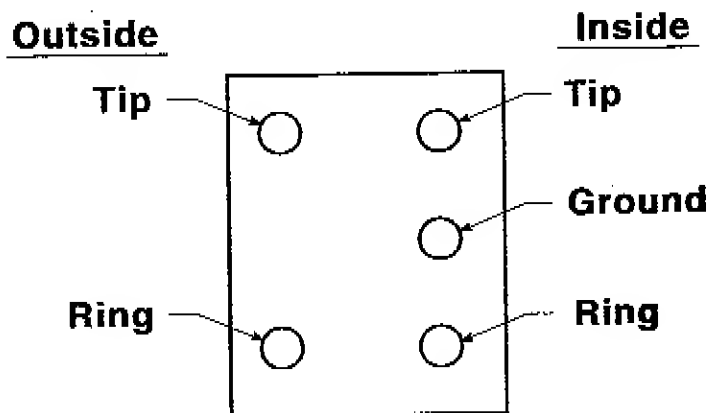
## Protector Layout



## Jumper Block Layout



## Protector Block Pins



## COSMIC FRAME AND BLOCK

## BASIC HI-CAP MAINTENANCE

### TEST METHODS AND ACCESS, continued

#### **Frame Test Access, continued**

The illustration on page 62 shows the cosmic frame layout:

- Protector mounting block on the protector side of the MDF
- No easy inside or outside test access points
- Protector module is removed for test access with a specially made adapter
- Jumper connection pins are located on blocks on the jumper side of the MDF
- Jumper block color is blue
- Amp-type cable connections to the horizontal cross-connect blocks
- Manufactured to receive 26-gauge wire

Cosmic frame punch down (zot) connections are normally made to receive 26-gauge wire. Terminating the 22-gauge shielded pair causes the wires to crimp and later break easily without visible damage. Minimize movement of wires around the blocks. Inspect these connections *carefully* when trouble is suspected in the C.O.

**CAUTION:** Cosmic frame layout and numbering is also known to cause confusion and subsequent delays in trouble isolation. Be *certain* of the module and pair you are working with. Double-check the area *before* removing modules for pair testing.

## GLOSSARY

## **BASIC HI-CAP MAINTENANCE**

### **Abbreviations, Acronyms, Mnemonics, & Terms**

The abbreviations, acronyms, mnemonics, and terms for Basic Hi-Cap Maintenance are as follows:

TERM	EXPLANATION/DEFINITION
AIS	Alarm Indication Signal
ALBO	Automatic Line Build-Out
AMI	Alternate Mark Inversion
B8ZS	Bipolar with 8 Zero Substitution
BERT	Bit Error Rate Test
BPV	BiPolar Violations
C.O.	Central Office (telco)
CLLI	Common Language Location Identifier
CLR	Circuit Layout Record
CNAS	Circuit Network Administration System
CONT	Continuous
CPE	Customer-Provided Equipment
CRC	Cyclic Redundancy Check
CRCC	Carrier Restoration Control Center

(continued)

# BASIC HI-CAP MAINTENANCE

## Abbreviations, Acronyms, Mnemonics, & Terms

TERM	EXPLANATION/DEFINITION
CSU	Channel Service Unit (Customer Service Unit)
DC	Direct Current
DCS	Digital Cross-connect System
Demarc	Demarcation Point - Point dividing telco from CPE
DS0	Digital Signal Level "0" - 64 Kb/s
DS1	Digital Signal Level "1" - 1.544 Mb/s
DS2	Digital Signal Level "2" - 6.312 Mb/s
DS3	Digital Signal Level "3" - 44.736 Mb/s
DSX	Digital Signal Cross-Connect
ESARTS	Enhanced Switched Access Remote Test System
ESF	Extended Super Frame
FLC	Facility Layout Card
FLR	Facility Layout Record
GND	Ground
Hi-Cap	High-Capacity DS1 Service

(continued)

<p style="text-align: center;"><b>BASIC HI-CAP MAINTENANCE</b> Abbreviations, Acronyms, Mnemonics, &amp; Terms</p>
--

TERM	EXPLANATION/DEFINITION
HUB	California Carrier Restoration Control Center (CRCC)
IC	Interexchange Carrier (a.k.a. Inter-Exchange Carrier [IXC])
INT	Internal
<i>Intrusive</i>	Out-of-Service Testing
kb/s	Kilobits per second
LCI	Learner-Controlled Instruction
LDN	Loop Down Code
LED	Light-Emitting Diode
LP Code	Loop Code
LTS	Line Terminating Shelf
Mb/s	Megabits per second
MDF	Main Distribution Frame
MON	DSX Monitor Jack
MPE	Minimum Point of Entry

(continued)

# **BASIC HI-CAP MAINTENANCE**

## **Abbreviations, Acronyms, Mnemonics, & Terms**

TERM	EXPLANATION/DEFINITION
NC	Network Channel
NCI	Network Channel Interface
NID	Network Interface Device
NIU	Network Interface Unit
<i>Non-Intrusive</i>	In-Service Testing/Monitoring
OL	Out of Limits
OTR	Office Terminating Repeater
PCM	Pulse Code Modulation
POI	Point of Interface
PWR	Power
QRSS	Quasi Random Signal Source
RCV	Receive
REACT	Remote Access Test System (Hekimian)
<i>Red Alarm</i>	Receive Alarm

(continued)

<p align="center"><b>BASIC HI-CAP MAINTENANCE</b>  <b>Abbreviations, Acronyms, Mnemonics, &amp; Terms</b></p>
---

TERM	EXPLANATION/DEFINITION
RX	Receive
SF	Super Frame (D4)
SFDS	Standard Fulfillment Design System
<i>Simplex Card</i>	Span Powering Card Within LTS
<i>Smart Jack</i>	NIU, NID
<i>Span</i>	A Repeated DS1 Copper Facility
SSMO	Special Safeguard Marking Order
SSO	Special Services Organization
STF	Span Terminating Frame
STS	Span Terminating Shelf
SYNC	Synchronous
T/R	Tip/Ring
T1	Digital Signal Level 1 - 1.544 Mb/s
T1.5	AT&T's reference for DS1 Hi-Cap
(continued)	

# **BASIC HI-CAP MAINTENANCE**

## **Abbreviations, Acronyms, Mnemonics, & Terms**

TERM	EXPLANATION/DEFINITION
------	------------------------

TDM	Time Division Multiplexing
-----	----------------------------

TED	Transmission Engineering Directive
-----	------------------------------------

telco	Telephone Company
-------	-------------------

TERM	Terminate
------	-----------

TL	Trace Lead for DSX LED Indicators
----	-----------------------------------

TTC	Telecommunications Techniques Corporation
-----	---

TX	Transmit
----	----------

V	Volts
---	-------

VDC	Volts Direct Current
-----	----------------------

VMDF	Vertical Main Distribution Frame
------	----------------------------------

VOM	Volt-Ohm Meter
-----	----------------

XMT	Transmit
-----	----------

<i>Yellow Alarm</i>	Transmit Alarm
---------------------	----------------

# **BASIC HI-CAP MAINTENANCE - TEST PROCEDURES**

## **TABLE OF CONTENTS**

	<b>PAGE</b>
<b>TEST PROCEDURES</b>	
Minimum Test Equipment Requirements . . . . .	1
Trouble Isolation Flowchart . . . . .	2
Test Equipment Self-Test . . . . .	4
Manual Loopback Patching . . . . .	5
In-Service Monitoring . . . . .	6
In-Service Monitoring Procedure . . . . .	7
Out-of-Service Test Setup . . . . .	10
Out-of-Service Test Procedure . . . . .	11
Span Power Measurements . . . . .	14
Span Power Test . . . . .	15
Span Voltage and Continuity Tests . . . . .	16
<b>TROUBLE SCENARIOS</b>	
Trouble Scenario #1 . . . . .	21
Trouble Scenario #2 . . . . .	22
Trouble Scenario #3 . . . . .	23

## **BASIC HI-CAP MAINTENANCE - TEST PROCEDURES**

### **MINIMUM TEST EQUIPMENT REQUIREMENTS**

Proper test equipment is essential to be successful in isolating DS1 Hi-Cap faults.

Minimum equipment requirements are as follows:

- DS1 signal analyzer such as the T-BERD 209A (or equivalent):
  - Recommended for DS1 analysis
  - Company standard
  - Can transmit and receive simultaneously
  - Supports industry standard testing
  - Widely available
  - Portable (battery option, desirable but not required)
- Standard digital Volt-Ohm Meter (VOM)

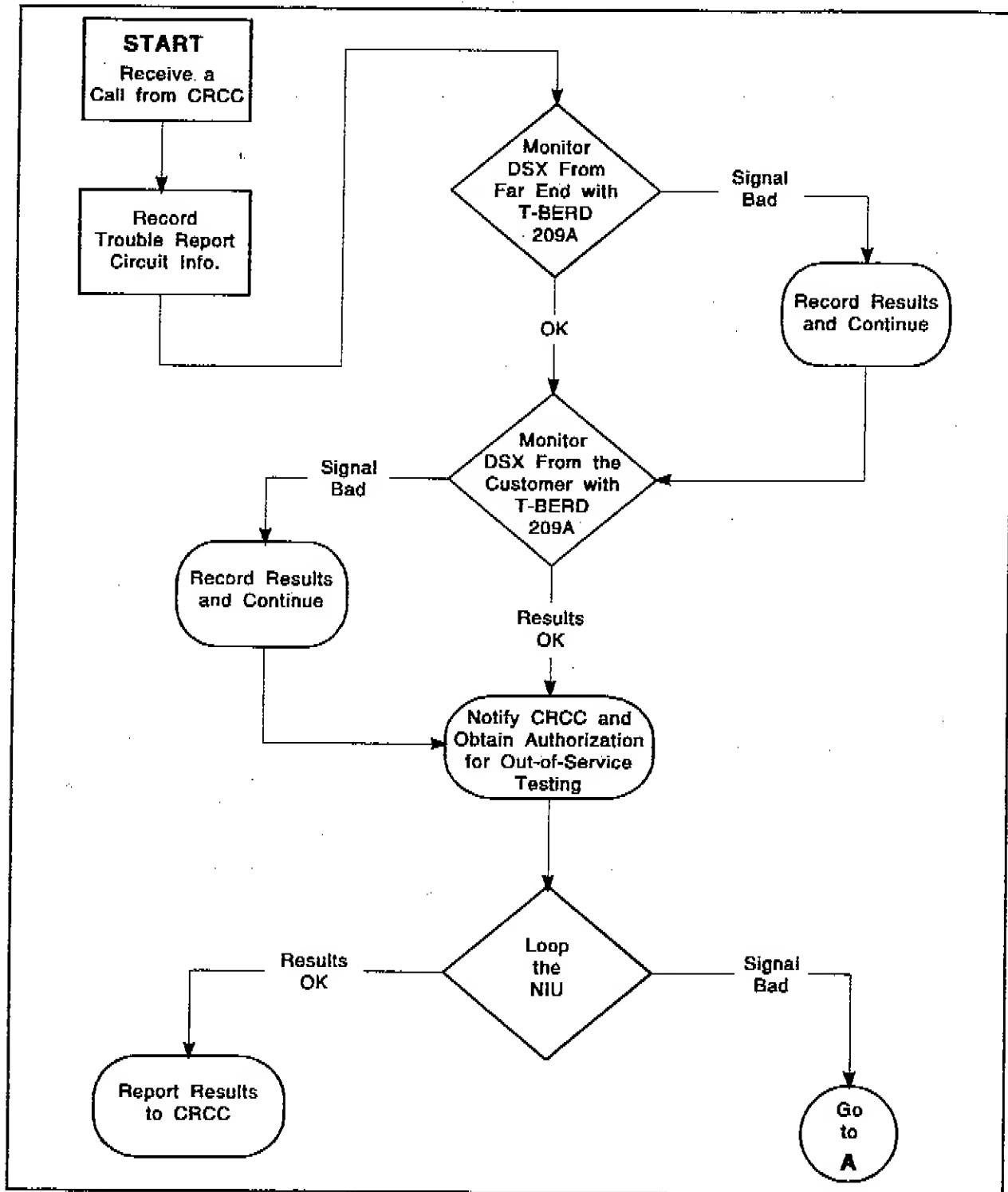
**CAUTION:** When using a DS1 analyzer, always check your patch cords by:

- Patching the transmit to receive.
- Confirming a good signal.

Dirty or bad cords commonly cause faulty readings, resulting in significant lost time.

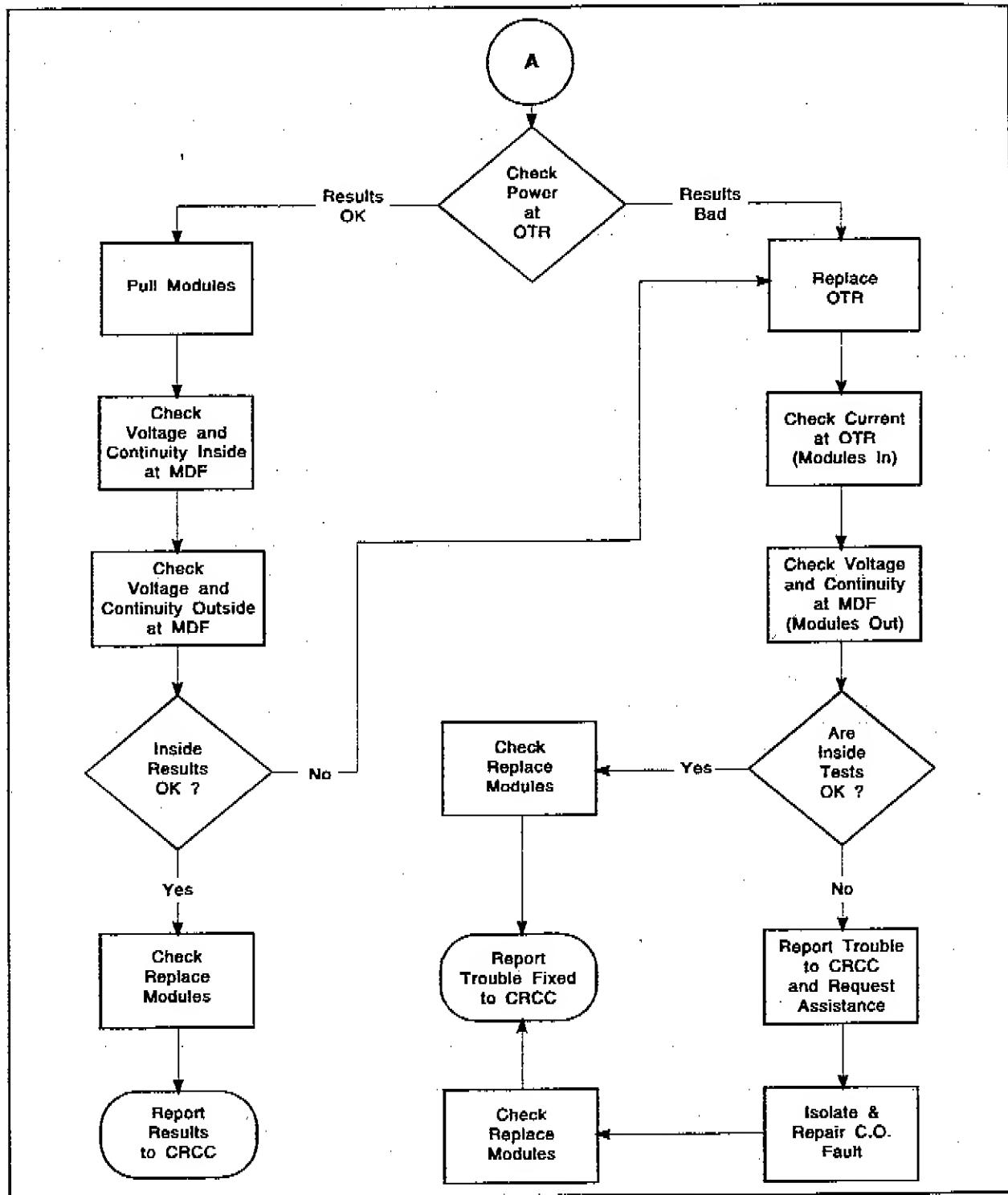
See the Appendix for the PSB-1000 listing of company standard PCM test equipment.

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



TROUBLE ISOLATION FLOWCHART  
Page 1 of 2

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



TROUBLE ISOLATION FLOWCHART  
Page 2 of 2

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

### TEST EQUIPMENT SELF-TEST

To isolate trouble, your test equipment *must* be in good working condition. The following procedures describe how to perform equipment self-tests for the DS1 analyzer (T-BERD 209A) and VOM.

STEP	PERFORMING T-BERD 209A SELF-TEST	RESULT
1	A. Press and hold the RESTART button. B. Turn on the power switch. C. Observe the center display window.	In 3-5 seconds:  CALIBRATING
2	A. Release the RESTART button. B. Observe the right window display and the status and alarm LEDs.	In 8-10 seconds: All LEDs illuminate RELOAD NOV-RAM
3	A. Press the RESTART button. B. Observe the window displays.	SELF TEST ALL ONES ALL RESULTS = OK
4	Verify that all the patch cords to be used are good:  A. Set MODE to AUTO TEST. B. Plug the patch cord into the RECEIVE and TRANSMIT jacks of the test set. C. Press the RESTART button. D. Observe the results. E. Perform the same operation on the other cords to be used.	Good cords will display the following:  T1 Pulses PATTERN SYNC FRAME SYNC ALL RESULTS OK

The following procedure describes how to check the Fluke Volt-Ohm Meter (VOM):

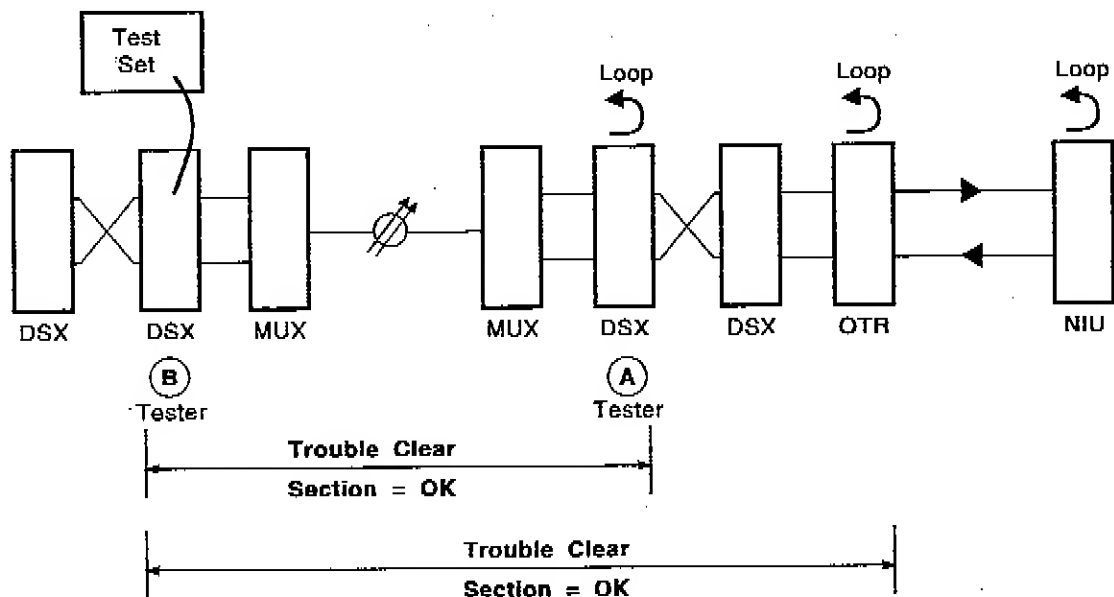
STEP	VOM - TEST LEAD CHECK	RESULT
1	Turn the VOM on.	
2	Select the OHMs function by pressing the OHMs switch.	
3	Select the 200 ohm scale.	
4	Insert the BLACK cord into the COMMON jack.	
5	Insert the RED cord into the VOLTS-OHMS jack.	
6	Short the probe tips together.	Display reads 0.1 or less

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

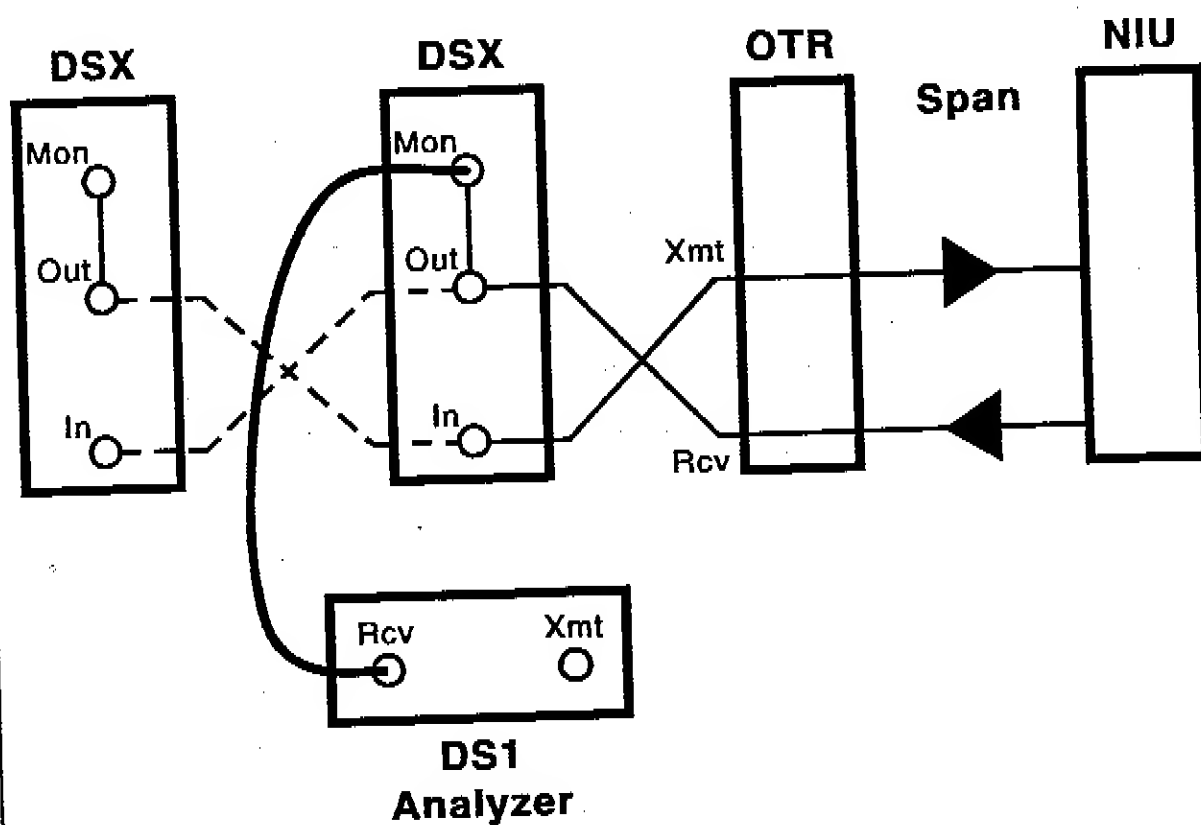
## MANUAL LOOPBACK PATCHING (Intrusive Testing)

A common method used to sectionalize DS1 trouble is the loopback patch. This method is usually performed under the direction of the CRCC and in cooperation with another tester. The customer *must* authorize intrusive testing. The procedure is described below:

STAGE	WHO DOES IT	WHAT HAPPENS
1	Tester A	Patches the transmit to the receive toward Tester B.
2	Tester B	Checks for a good signal, which indicates the trouble has been cleared.  <b>NOTE:</b> If the trouble clears, the section of the facility between Tester B and the loopback is okay.
3	Tester A	Moves the loopback patch further down the facility.  <b>NOTE:</b> Place loopback patches in standard test jack access points only. Do <b>not</b> attempt hard-wired loopbacks on frames or other wiring connections.



## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



IN-SERVICE MONITORING

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

## IN-SERVICE MONITORING PROCEDURE

Page 1 of 2

The following procedure describes how to perform an in-service monitor test using a T-BERD 209A:

STEP	PERFORMING IN-SERVICE MONITORING	RESULT
1	Perform the power-up self-test procedure.  <b>NOTE:</b> Use known good patch cords.	SELF TEST = OK ALL RESULTS OK
2	MODE switch =                      Select AUTO as displayed in the left window.	AUTO
3	RESULTS I switch =              Set to SUMMARY.	SUMMARY
4	TEST switch =                      Set to CONT for continuous testing.	CONT
5	RECEIVE INPUT switch          Set to DSX MON.	DSX MON
6	Connect the RECEIVE jack of the test set to the DSX MON jack associated with the customer end under test. Refer to the FLR for the DSX location.	
7	Press the RESTART button on the test set to begin service monitoring.	
8	Observe the test set displays and report them to the CRCC. A <i>normal</i> circuit indicates the LEDs and displays in the results column.  <b>NOTE:</b> The "B8ZS" LED is illuminated only when B8ZS line coding is received. When AMI line coding is being received the B8ZS LED is <b>not</b> illuminated.	Good circuit conditions are:  T1 PULSES FRAME SYNC  (Ignore: Pulse Shape LED)  ALL RESULTS OK Framing type is displayed

(continued)

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

### IN-SERVICE MONITORING PROCEDURE

Page 2 of 2

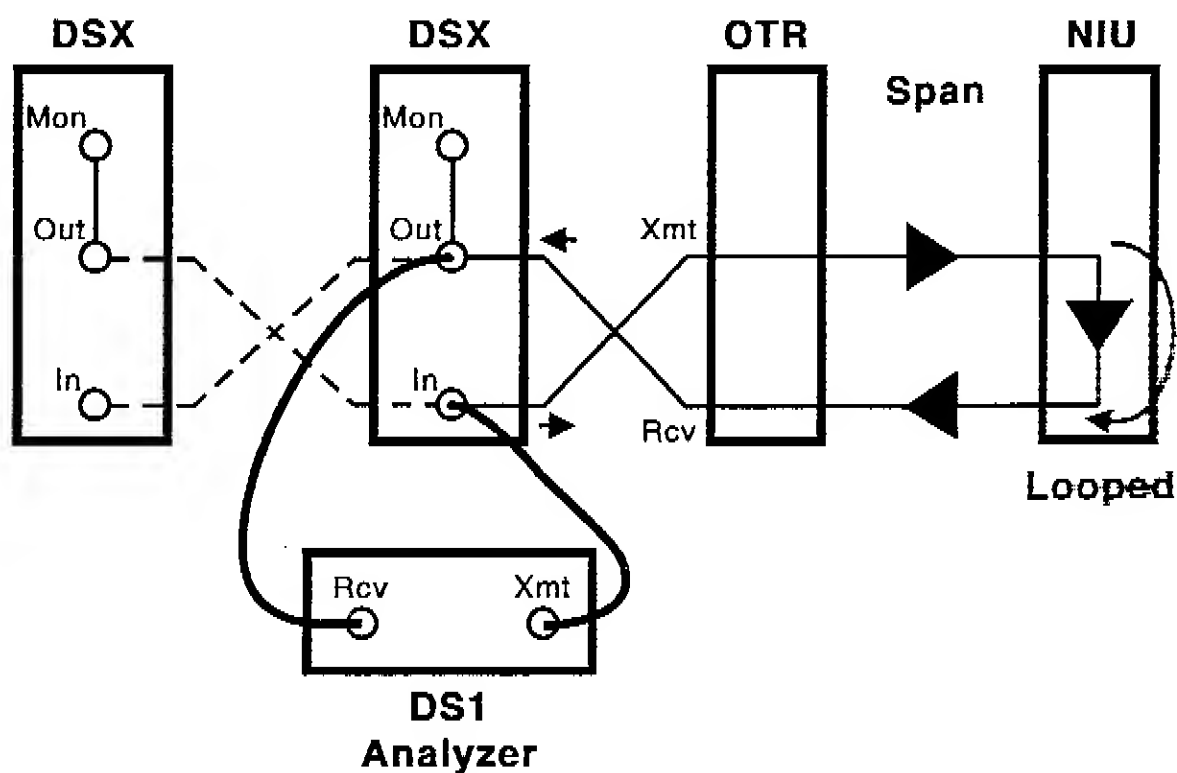
STEP	PERFORMING IN-SERVICE MONITORING	RESULT
9	<p>Observe <i>trouble</i> condition results and report them to the CRCC, if applicable. Any RED signal alarm LEDs illuminated in the upper right of the test set indicates circuit trouble.</p> <p><b>Do not</b> remove or change the test setup.</p> <p><b>NOTE:</b> You <i>must</i> obtain proper authorization from the customer or CRCC <i>before</i> proceeding to conduct out-of-service testing.</p>	<p>Trouble circuit conditions are:</p> <p>RED ALARM LEDs</p> <p>Errors/other indications in the RESULTS I display</p>

**NOTE:** For additional information on how to interpret test set results, see the charts in the Appendix - Technical Information Section.

## **BASIC HI-CAP MAINTENANCE - TEST PROCEDURES**

### **NOTES**

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



OUT-OF-SERVICE TEST SETUP

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

### OUT-OF-SERVICE TEST PROCEDURE

Page 1 of 2

The following procedure describes how to perform out-of-service testing using a T-BERD 209A to loopback the NIU device at the customer premises:

STEP	PERFORMING OUT-OF-SERVICE TESTING - NIU	RESULT
1	Verify the customer has authorized intrusive testing.  <b>NOTE:</b> Use known good patch cords.	
2	Perform the self-test procedure on the T-BERD 209A.	ALL RESULTS = OK
3	MODE switch = Select the display of T1	T1
4	PATTERN switch = Select the T1-QRSS test pattern.	T1-QRSS
5	TIMING switch = Set to INT for internal timing.	INT
6	TEST switch = Set to CONT for continuous testing.	CONT
7	CODE switch = Set to the AMI line code.	AMI
8	ERROR INSERT buttons = Ensure all three are in the OFF position, no LEDs illuminated.	No LEDs
9	RECEIVE INPUT switch = Set to TERM to terminate the DSX signal at the out jack.	TERM
10	TRANSMIT OUTPUT switch = Set to 0 dB (DSX) send level.	0dB(DSX)
11	MODE switch = Select the AUX function.	AUX
12	PATTERN switch = Select the LPCODE function.	LPCODE
13	RESULTS I switch = Select the FAC2 NIU loop code.	FAC2
14	MODE switch = Reselect the T1 mode.	T1

(continued)

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

## OUT-OF-SERVICE TEST PROCEDURE

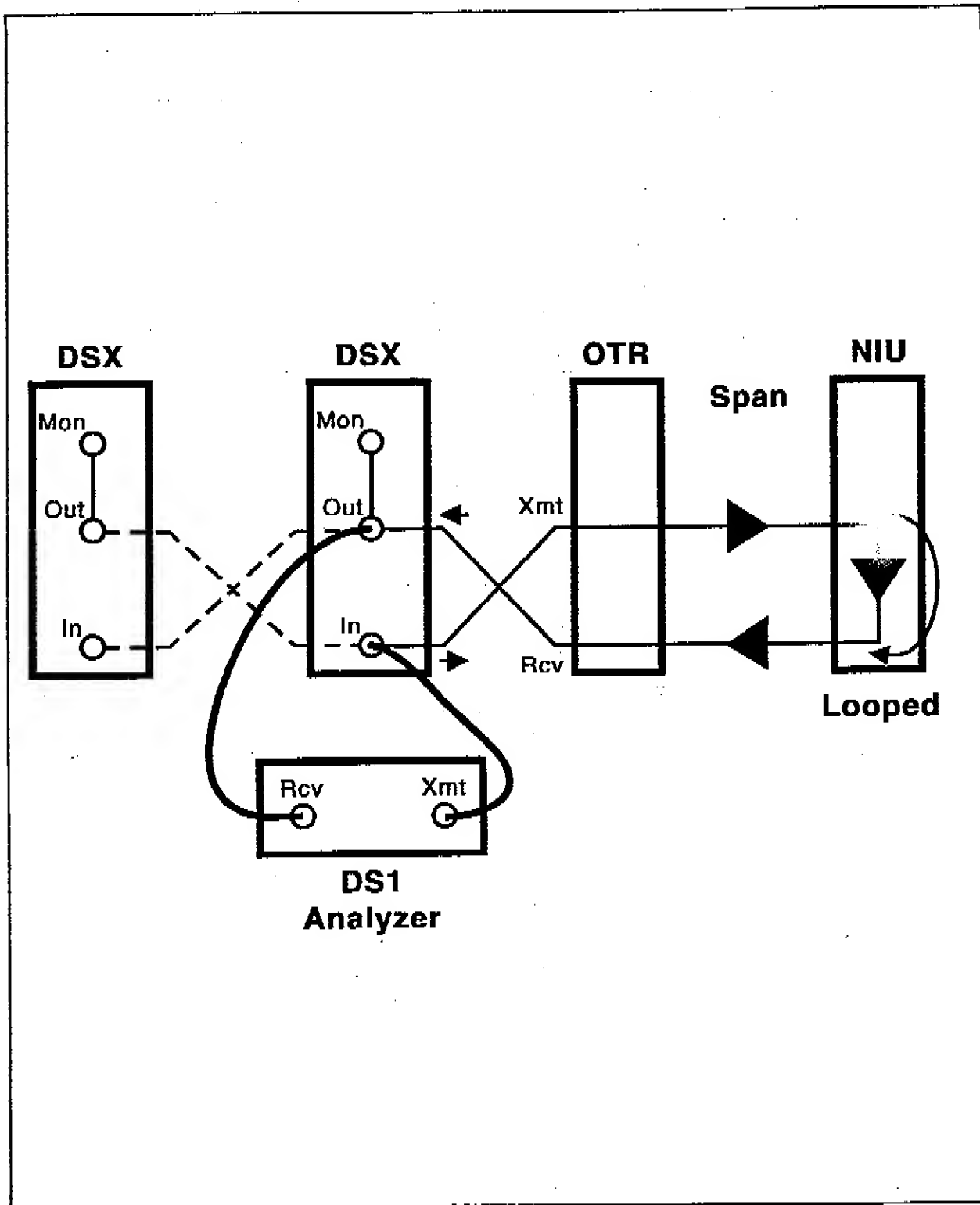
Page 1 of 2

The following procedure describes how to perform out-of-service testing using a T-BERD 209A to loopback the NIU device at the customer premises:

STEP	PERFORMING OUT-OF-SERVICE TESTING - NIU	RESULT
1	Verify the customer has authorized intrusive testing.  <b>NOTE:</b> Use known good patch cords.	
2	Perform the self-test procedure on the T-BERD 209A.	ALL RESULTS = OK
3	MODE switch = Select the display of T1	T1
4	PATTERN switch = Select the T1-QRSS test pattern.	T1-QRSS
5	TIMING switch = Set to INT for internal timing.	INT
6	TEST switch = Set to CONT for continuous testing.	CONT
7	CODE switch = Set to the AMI line code.	AMI
8	ERROR INSERT buttons = Ensure all three are in the OFF position, no LEDs illuminated.	No LEDs
9	RECEIVE INPUT switch = Set to TERM to terminate the DSX signal at the out jack.	TERM
10	TRANSMIT OUTPUT switch = Set to 0 dB (DSX) send level.	0dB(DSX)
11	MODE switch = Select the AUX function.	AUX
12	PATTERN switch = Select the LPCODE function.	LPCODE
13	RESULTS I switch = Select the FAC2 NIU loop code.	FAC2
14	MODE switch = Reselect the T1 mode.	T1

(continued)

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



OUT-OF-SERVICE TEST SETUP

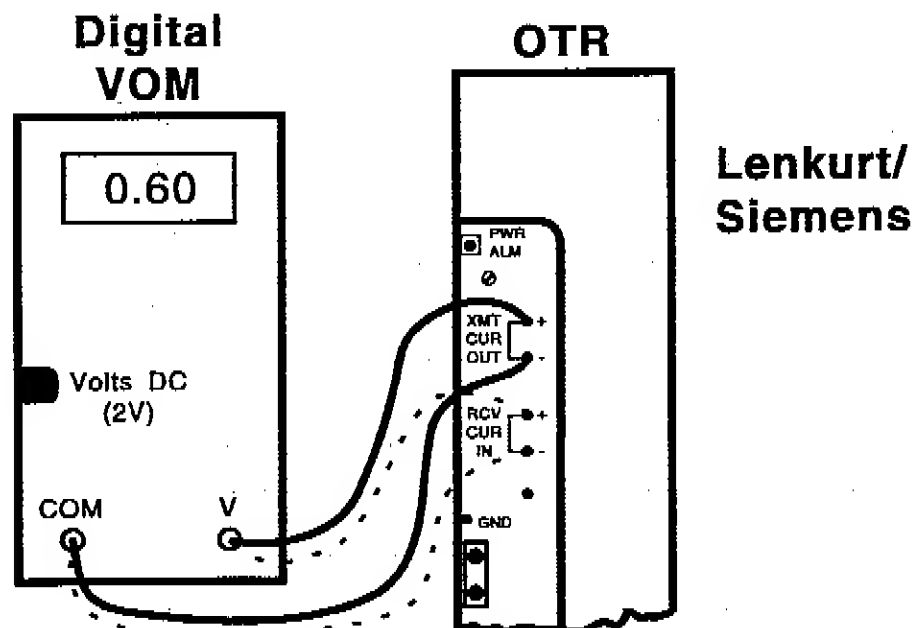
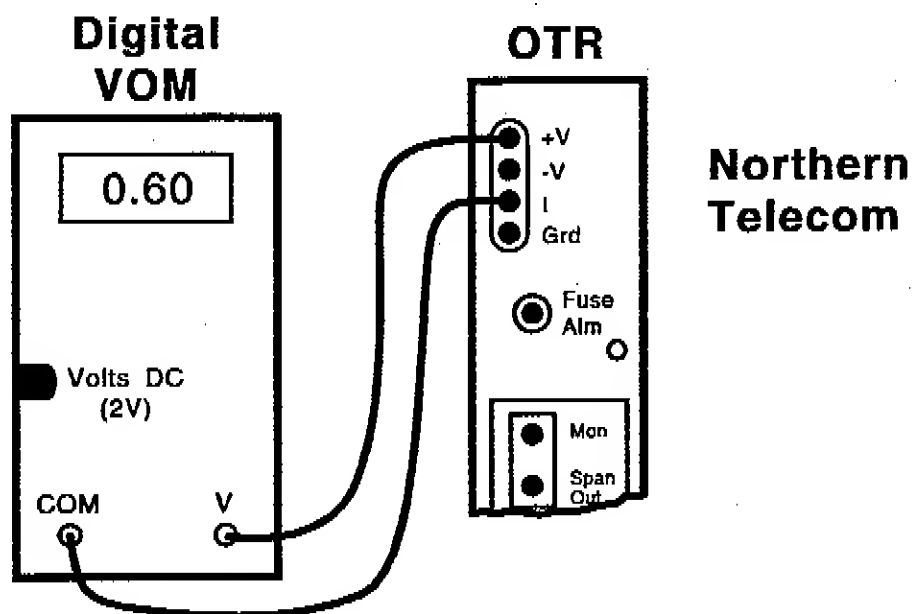
# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

## OUT-OF-SERVICE TEST PROCEDURE

Page 2 of 2

STEP	PERFORMING OUT-OF-SERVICE TESTING - NIU	RESULT
15	Insert a patch cord from the test set TRANSMIT jack to the DSX IN jack toward the end to be tested.	
16	Insert a patch cord from the test set RECEIVE jack to the DSX OUT jack toward the end to be tested.	
17	Press the SEND LOOP UP button.	RECEIVE LOOP UP blinks
18	Observe the STATUS indicator LEDs. Good circuit conditions are shown at the right.	T1 PULSES LED FRAME SYNC LED PATTERN SYNC LED
19	MODE switch =                      Select the AUTO mode and observe the test results in the RESULT II window.	ALL RESULTS OK
20	RESTART switch =                      Press RESTART to begin continuous testing.	
21	RESULTS I switch =                      Select the SUMMARY display function.	Good circuit: ALL RESULTS OK
22	If any faults exist, use the RESULTS I SCROLL switch to view the errors detected. Observe any RED ALARM LEDs that may be illuminated.	Faulty circuit: VIOLATIONS or ERRORS
23	Record the results and any ALARM LEDs.	
24	Press the SEND LOOP-DOWN button to release the NIU loop condition.	Do not be concerned with alarm displays
25	Remove the patch cords from the DSX jacks.	
26	If the local loop failed or a trouble condition is observed, proceed to repeater power and frame voltage checks.	If faulty circuit condition, proceed to span tests
27	If a far end loop is requested by the CRCC, repeat steps 15-25 using the DSX jack assignments for the far end facility.	
28	If ALL RESULTS OK, call the CRCC to refer trouble to customer/CPE.	No trouble detected
29	Restore all SSMO treatment and install any missing SSMO treatment.	

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



### SPAN POWER MEASUREMENTS

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

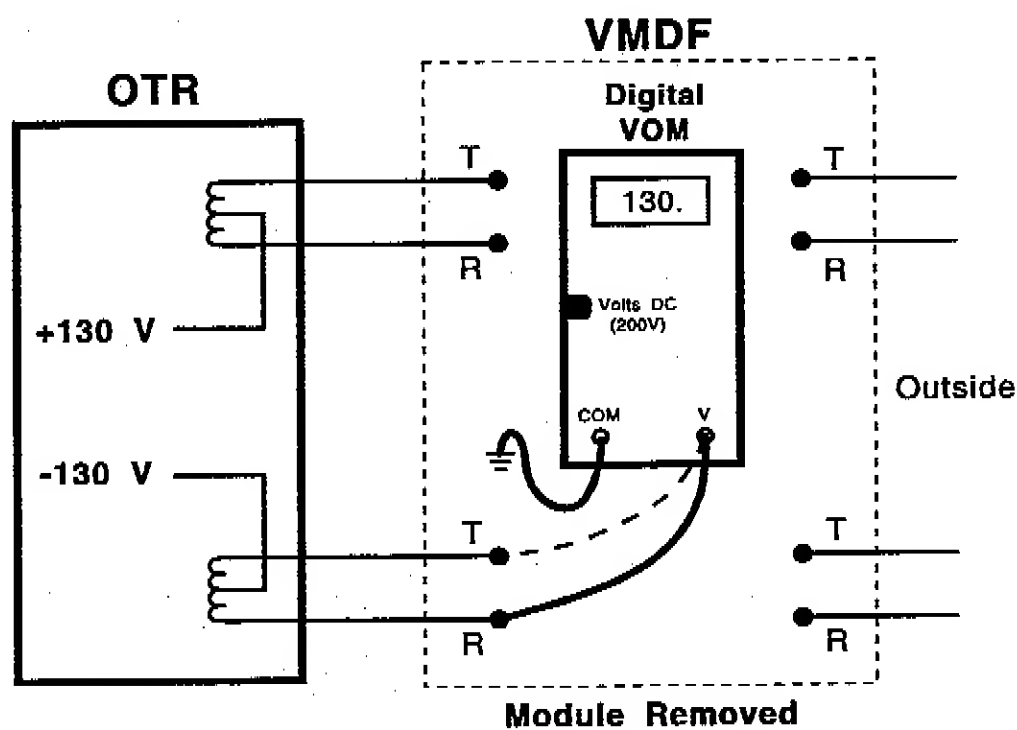
## SPAN POWER TEST

The following procedure describes how to take current measurements at the OTR.

STEP	TAKING CURRENT MEASUREMENTS AT THE OTR	RESULTS																				
1	Select the VOLT and DC functions on the VOM.																					
2	Select the TWO VOLT scale.																					
3	<p>Measure the voltage by inserting the RED and BLACK test probes into the correct test jacks on the face of the OTR as indicated:</p> <hr/> <table><tr><td>MANUFACTURER</td><td>TEST POINTS</td></tr><tr><td colspan="2"><hr/></td></tr><tr><td>Northern Telecom</td><td><ul style="list-style-type: none"><li>• Red probe to jack +V</li><li>• Black probe to jack I</li></ul></td></tr><tr><td colspan="2"><hr/></td></tr><tr><td>Siemens/Lenkurt</td><td><ul style="list-style-type: none"><li>• Red probe to jack XMT CUR OUT (+)</li><li>• Black probe to jack XMT CUR OUT (-)</li></ul></td></tr><tr><td colspan="2">AND</td></tr><tr><td></td><td><ul style="list-style-type: none"><li>• Red probe to jack RCV CUR IN (+)</li><li>• Black probe to jack RCV CUR IN (-)</li></ul></td></tr><tr><td colspan="2"><p>The measurements at the XMT and RCV test points should be within about .03 volts of each other. Greater differences indicate an outside facility problem.</p></td></tr><tr><td colspan="2"><hr/></td></tr><tr><td colspan="2"><p><b>NOTE:</b> The OTR current adjust/rating <i>must</i> be marked on a tag on the face plate of the OTR plug-in card, such as 60 ma or 100 ma or 140 ma.</p></td></tr></table>	MANUFACTURER	TEST POINTS	<hr/>		Northern Telecom	<ul style="list-style-type: none"><li>• Red probe to jack +V</li><li>• Black probe to jack I</li></ul>	<hr/>		Siemens/Lenkurt	<ul style="list-style-type: none"><li>• Red probe to jack XMT CUR OUT (+)</li><li>• Black probe to jack XMT CUR OUT (-)</li></ul>	AND			<ul style="list-style-type: none"><li>• Red probe to jack RCV CUR IN (+)</li><li>• Black probe to jack RCV CUR IN (-)</li></ul>	<p>The measurements at the XMT and RCV test points should be within about .03 volts of each other. Greater differences indicate an outside facility problem.</p>		<hr/>		<p><b>NOTE:</b> The OTR current adjust/rating <i>must</i> be marked on a tag on the face plate of the OTR plug-in card, such as 60 ma or 100 ma or 140 ma.</p>		<p>Results vary depending on the field span repeater type:</p> <p>60 ma = .57 to .63 VDC</p> <p>OR</p> <p>100 ma = .95 to 1.05 VDC</p> <p>OR</p> <p>140 ma = 1.33 to 1.47 VDC</p>
MANUFACTURER	TEST POINTS																					
<hr/>																						
Northern Telecom	<ul style="list-style-type: none"><li>• Red probe to jack +V</li><li>• Black probe to jack I</li></ul>																					
<hr/>																						
Siemens/Lenkurt	<ul style="list-style-type: none"><li>• Red probe to jack XMT CUR OUT (+)</li><li>• Black probe to jack XMT CUR OUT (-)</li></ul>																					
AND																						
	<ul style="list-style-type: none"><li>• Red probe to jack RCV CUR IN (+)</li><li>• Black probe to jack RCV CUR IN (-)</li></ul>																					
<p>The measurements at the XMT and RCV test points should be within about .03 volts of each other. Greater differences indicate an outside facility problem.</p>																						
<hr/>																						
<p><b>NOTE:</b> The OTR current adjust/rating <i>must</i> be marked on a tag on the face plate of the OTR plug-in card, such as 60 ma or 100 ma or 140 ma.</p>																						

**NOTE:** Current measurements are indicated by volts DC, rather than milliamps, because the test reading is indicating the voltage drop across a precision 10-ohm resistor. To translate volts to milliamps, move the decimal point two places to the right. For example, 0.61 volts across the resistor equals 61 milliamps.

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



SPAN VOLTAGE & CONTINUITY TESTS

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

## SPAN VOLTAGE AND CONTINUITY TESTS

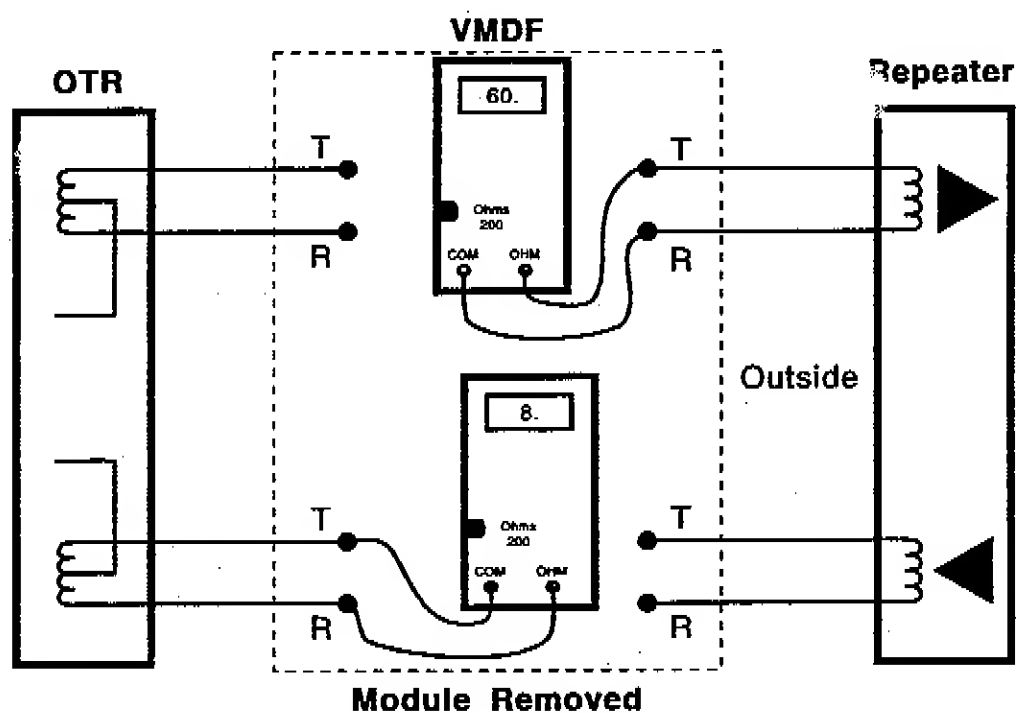
Page 1 of 3

The following procedure describes how to take voltage and continuity measurements at the VMDF.

STEP	TAKING VOLTAGE AND CONTINUITY MEASUREMENTS (VMDF)	RESULTS
1	Identify and verify TRANSMIT and RECEIVE cable pairs at the VMDF.  <b>NOTE:</b> Cable pair information is found on the FLR, the OTR trace cards, and on the SSMO tag.	
2	Remove both solid-state protector modules.  <b>CAUTION:</b> An <b>electrical shock hazard</b> exists on connector blocks, wire-wrap pins, and equipment cabling due to span power voltage levels.	
3	Set the VOM for the 200 VDC scale.	
4	Identify a good ground reference on the VMDF.	
5	Attach the BLACK (Common) probe to GROUND.	
6	Make the following measurements on the office side of the Protector Block by placing the RED probe to each of the pins and note the voltage reading:  • Northern Telecom: Transmit Tip +130 VDC Transmit Ring +130 VDC Receive Tip -130 VDC Receive Ring -130 VDC  • Siemens/Lenkurt (one of four possible power configurations):  1 2 3 4  Transmit Tip Gnd +130VDC +130VDC +130VDC Transmit Ring Gnd +130VDC +130VDC +130VDC Receive Tip -48V Gnd -130VDC -48V Receive Ring -48V Gnd -130VDC -48V	Readings, as noted at the left, + or - 5%

(continued)

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES



### SPAN VOLTAGE & CONTINUITY TESTS

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

## SPAN VOLTAGE AND CONTINUITY TESTS

Page 2 of 3

STEP	TAKING VOLTAGE AND CONTINUITY MEASUREMENTS (VMDF)	RESULTS
7	<p>Check for foreign voltage on the cable side test access of all four conductors of the cable pairs.</p> <p><b>NOTE:</b> A high voltage reading may indicate the correct module was <b>NOT</b> removed.</p>	0.1 VDC
8	Set the VOM to the OHM function and the 200 ohms scale and check for foreign GND on the outside cable test points of all four conductors.	> 30 kohms
9	<p>Check continuity between the TIP and RING of both pairs toward the <i>outside</i> field repeater. At the <i>outside</i> pair test access, place one test probe on the TIP and the other on the RING.</p> <p>If resistance measurements are out of range or more than 5-10 ohms difference between pairs, there may be trouble <i>outside</i>. Refer results to the CRCC for span maintenance.</p>	50 to 110 ohms
10	Check continuity between the TIP & RING of both pairs on the office side ( <i>inside</i> ) toward the OTR. At the <i>inside</i> pair test access, place one test probe on the T and the other on the R.	6 to 15 ohms
11	<p>If you received any abnormal readings (beyond the range noted in the results column) on <i>inside</i> conductors in Steps 6 and 10, there is a trouble condition in the C.O.:</p> <p>A. Make a quick check for broken VMDF shielded pair connections at the MDF. History has shown broken connections at the MDF to be a prime cause of Hi-Cap facility problems.</p> <p>B. Repair any broken connections.</p> <p>C. Check and reinstall the protector modules.</p> <p>If no broken connections are immediately found, proceed to Step 12.</p>	

(continued)

# BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

## SPAN VOLTAGE AND CONTINUITY TESTS

Page 3 of 3

STEP	TAKING VOLTAGE AND CONTINUITY MEASUREMENTS (VMDF)	RESULTS
12	<p>If no jumper faults are found, change out the OTR. History reflects the OTR to be a second prime cause of Hi-Cap facility problems:</p> <ul style="list-style-type: none"> <li>A. Remove the suspect repeater.</li> <li>B. Verify that the fuse(s) mounted on the replacement repeater is <b>not</b> open/blown.</li> <li>C. Verify that the replacement repeater's issue, model, and options are the same as the one removed.</li> <li>D. Insert the new repeater.</li> <li>E. Repeat the Current Measurement procedure on page 13 in this Section, with protector modules installed.</li> <li>F. Remove both protector modules.</li> <li>G. Repeat Step 6 (inside voltage) and Step 10 (inside continuity) tests.</li> <li>H. Ensure that the replacement repeater has the proper current rating sticker, e.g., 60 ma.</li> <li>I. If repeater replacement does <b>not</b> clear the trouble condition, place the original repeater back in its original circuit position.</li> </ul>	
13	<p>Inform the CRCC that the trouble is in the C.O. if replacing the OTR did not clear the trouble conditions.</p> <p>AND</p> <p>Request assistance in isolating the <i>inside</i> fault.</p>	
14	<p>Isolate and repair the C.O. trouble. Don't forget to check and reinstall both protector modules.</p>	

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

### TROUBLE SCENARIO #1

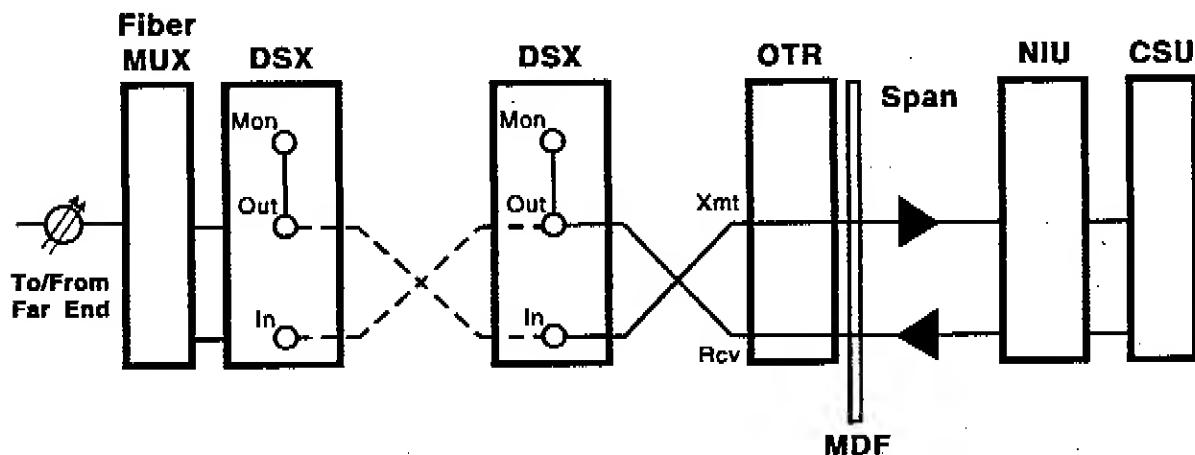
#### CONDITIONS:

- Our customer has reported their Hi-Cap circuit is down.
- Preliminary testing by the connecting Telco indicates the trouble is in your Central Office (C.O.) or local facilities.
- You (the C.O. Technician) have been referred the trouble report and circuit number along with a request to isolate the trouble.
- During your troubleshooting activity, assume the DS1 analyzer indicates errors when checking the circuit.

#### ACTIVITY:

The class working as a team must briefly outline the steps you will take to isolate the trouble IN or OUT of your C.O. You have 5 minutes to decide and agree on your course of action.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- n. \_\_\_\_\_



## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

### TROUBLE SCENARIO #2

#### CONDITIONS:

- During the previous activity (Trouble Scenario #1) you recorded the following test results.

- In-service monitoring indicates errors from the local customer.
- Loopback testing did **not** indicate "normal" circuit conditions.
- Span power measurement = .58 vdc
- Inside voltage test results at the MDF are:

XMT T	=	+126	VDC	RCV T	=	-0.1	VDC
XMT R	=	+126	VDC	RCV R	=	-130	VDC

- Outside foreign voltage test results at the MDF are:

XMT T	=	+0.0	VDC	RCV T	=	-0.0	VDC
XMT R	=	+0.0	VDC	RCV R	=	-0.0	VDC

- Outside foreign ground tests results at the MDF are:

XMT T	=	OL	ohms	RCV T	=	OL	ohms
XMT R	=	OL	ohms	RCV R	=	OL	ohms

- Outside continuity test results at the MDF are:

XMT T/R	=	80	ohms
RCV T/R	=	82	ohms

- Inside continuity test results at the MDF are:

XMT T/R	=	10	ohms
RCV T/R	=	OL	ohms

#### ACTIVITY:

- Identify the trouble condition.
- Identify the most likely location of the trouble condition.
- What corrective action will you take to restore service?

## BASIC HI-CAP MAINTENANCE - TEST PROCEDURES

### TROUBLE SCENARIO #3

#### CONDITIONS:

- During the first activity (Trouble Scenario #1) you recorded the following test results.
  - In-service monitoring indicates errors from the local customer.
  - Loopback testing did **not** indicate "normal" circuit conditions.
  - Span power measurement = .61 vdc
  - Inside voltage test results at the MDF are:  

XMT T	=	+126	VDC	RCV T	=	-130	VDC
XMT R	=	+126	VDC	RCV R	=	-130	VDC
  - Outside foreign voltage test results at the MDF are:  

XMT T	=	+0.0	VDC	RCV T	=	-0.0	VDC
XMT R	=	+0.0	VDC	RCV R	=	-0.0	VDC
  - Outside foreign ground tests results at the MDF are:  

XMT T	=	OL	ohms	RCV T	=	OL	ohms
XMT R	=	OL	ohms	RCV R	=	OL	ohms
  - Outside continuity test results at the MDF are:  

XMT T/R	=	80	ohms
RCV T/R	=	82	ohms
  - Inside continuity test results at the MDF are:  

XMT T/R	=	10	ohms
RCV T/R	=	10	ohms

#### ACTIVITY:

- Identify the trouble condition.
- Identify the most likely location of the trouble condition.
- What corrective action will you take to restore service?

# APPENDIX

# BASIC HI-CAP MAINTENANCE

## Technical Information

### SIGNAL STATUS INDICATORS (T-BERD 209A)

INDICATOR (GREEN LED)	DESCRIPTION
T1 PULSES	T1 pulses are detected.
T1C PULSES	T1C pulses are detected.
PATTERN SYNC	Pattern synchronization is achieved. This LED will <b>not</b> normally be illuminated during in-service testing.
FRAME SYNC	The test set has achieved synchronization to the appropriate framing pattern (only when the signal monitored contains a framed format).
B8ZS	B8ZS line coding is present (clear channel).

ALARM (RED LED)	CRITERIA
SIGNAL LOSS	No pulses are detected.
PATTERN LOSS	250 bit errors are counted in less than 1,000 bits of test pattern data (out-of-service testing only).
FRAME LOSS	2 of 5 framing bits are in error for D4, ESF, or SLC-96 framing.
ONES DENSITY	The received signal does <b>not</b> meet standards of at least one 1s bit in 8 (ones density of 12.5%).
EXCESS ZEROS	16 or more consecutive 0s occur for T1.
YELLOW ALARM	Indicates the end of the circuit being monitored has lost its receive signal or framing.
ALL ONES	An all ones test pattern or Alarm Indication Signal (AIS) is detected—may be an indication of upstream facility problems.
PULSE SHAPE	T1 pulse shape does <b>not</b> fit the selected pulse template.  <b>NOTE:</b> The LED may be illuminated during a monitor test. It is valid only during out-of-service testing with specific patterns.
LOW BATTERY	Approximately 15 minutes of operation are left <i>before</i> the battery is completely drained of power.
POWER LOSS	Illuminated when the T-BERD is powered up, either after being manually turned off or after a power loss.

## BASIC HI-CAP MAINTENANCE

### Technical Information

#### INTERPRETATION FOR IN-SERVICE MONITOR RESULTS (T-BERD 209A)

RESULTS (Monitor the Span, NE)	DISPLAY MEASUREMENT	POSSIBLE CAUSE/LOCATION
BPVs	VIOLATIONS	Possibly a bad repeater or improper cabling; the CSU corrects BPVs before they are introduced onto the span. Noise generated near the span can also contribute to errors received at the CSU.
Frame Errors CRC Errors No BPV Errors	FRM ERRORS CRC ERRORS VIOLATIONS	A multiplexer or channel bank at the far end may be responsible.
Frame Errors CRC Errors BPV Errors	FRM ERRORS CRC ERRORS VIOLATIONS	These errors are often caused by a bad repeater, span line noise, or crosstalk in the local cable.
Frame Errors Excessive Zeros Ones Density	FRM ERRORS	A far end problem possibly due to a transmitter that is <b>not</b> meeting pulse density specifications.
BPV Errors Frame Errors CRC Errors Excessive Zeros Ones Density	VIOLATIONS FRM ERRORS CRC ERRORS	Repeaters may induce these errors when subject to long strings of 0s. The termination equipment at the customer premises may <b>not</b> be ensuring that the data is meeting 1s density requirements.
Frequency	RX FREQ, Hz	The received frequency should be approximately from 1,543,925 to 1,544,075 (1.544 MHz + or - 75 Hz). Compare the transmitted and received frequencies. Differences can induce timing slips.
Receive Level	RX LEVEL dBdsx	The received level should be in the range of -16 to -24 dBdsx for DSX MON jacks. Levels outside this range may indicate that an open or short exists between the DSX and OTR (or equipment the jack is cabled to).

**NOTE:** The above results assume the monitor is being performed on the DSX MON jack associated with the local end-user facility. The local facility is made up of a copper repeater-equipped span line.

# BASIC HI-CAP MAINTENANCE

## Technical Information

### INTERPRETATION FOR OUT-OF SERVICE TEST RESULTS (T-BERD 209A)

RESULTS	DISPLAY MEASUREMENT	POSSIBLE CAUSE/LOCATION
BPVs	VIOLATIONS	Possibly a bad repeater or improper cabling. Noise generated near the span can also contribute to errors received at the NIU.
Frame Errors CRC Errors BPV Errors	FRM ERRORS CRC ERRORS VIOLATIONS	These errors are often caused by a bad repeater, span line noise, or crosstalk in the local cable.
BPVs Bit Errors	VIOLATIONS BIT ERRORS	These errors are often caused by a bad repeater, span line noise, or crosstalk in the local cable.
Bit Errors No BPVs	BIT ERRORS VIOLATIONS	When in the loopback configuration, some NIUs remove BPVs. If this is the case, the problem is most likely on the transmit side of the span line (the customer's receive).
Receive Level	RX LEVEL dBdsx	The receive level should be in the range of -16 to -24 dBdsx for DSX MON jacks. Levels outside this range may indicate that an open or short exists between the DSX and OTR (or equipment the jack is cabled to).

**NOTE:** The above test results assume an NIU loopback was performed on the NIU at the local customer end.

# **BASIC HI-CAP MAINTENANCE**

## **Technical Information**

### **ADDITIONAL TERMS**

#### ***Acceptance Limits***

The tariff required performance parameters associated with DS1 Hi-Cap service are normally measured by:

- Three 15 minute pattern tests with less than 20 errored seconds each. In practice, there should be zero errored seconds for all three tests.
- Availability of 99.925 percent per year or better.
- Jitter at less than 14 unit intervals.

#### ***Alarm Indication Signal***

AIS is an unframed "all-ones" signal that is normally transmitted by multiplex or interface equipment (NIU or CSU) upon the loss of incoming signal and continues for the duration of the service loss. This is also known as a "blue" alarm and is a useful tool in analyzing network facility conditions.

#### ***ALBO***

Automatic Line Build-Out is a circuit that compensates for attenuation and phase distortion, normally seen in repeater circuits and NIU devices.

#### ***All Ones***

See stress patterns.

#### ***AMI***

Alternate Mark Inversion is also known as bipolar signal format in which consecutive ones bits alternate positive and negative polarity of equal amplitude. A zero bit is no pulse or ground reference potential.

---

(continued)

# BASIC HI-CAP MAINTENANCE

## Technical Information

### ADDITIONAL TERMS, continued

#### **Availability**

Availability is the measure of time that a service is *usable* by the customer, represented as a percent over a consecutive 12-month period.

- Unavailable = a bit error rate greater than  $10^{-3}$  in a ten second interval.
- Out-of-Service limit is a bit error rate greater than  $10^{-3}$  in a ten second interval. At this error rate corrective action *must* be taken.

#### **BER**

Bit Error Rate is the ratio of the number of logical bit errors to total number of bits transmitted in a given time. BER is often expressed in exponents such as those listed below. GTEs objective for T1 facilities is  $10^{-9}$ .

1 error per 1,000 bits	= $10^{-3}$
1 error per 1,000,000 bits	= $10^{-6}$
1 error per 1,000,000,000 bits	= $10^{-9}$

#### **Bit Error**

A bit error is the generation or deletion of a "1" pulse between the transmit data and the distant end received data. Also known as a *logic error*. Simply stated, a zero that should be a one or a one that should be a zero.

#### **BPV**

A bipolar violation is two consecutive pulses of the same polarity in a bipolar signal or Alternate Mark Inversion (AMI) line code.

(continued)

# BASIC HI-CAP MAINTENANCE

## Technical Information

### ADDITIONAL TERMS, continued

<b>CCC</b>	Clear Channel Capability provides the customer with a complete 64 kb/s per channel (DS0) without bit robbing. CCC requires the use of B8ZS to prevent excess zeros on the facilities.
<b>CRC</b>	Cyclic Redundancy Check is an extremely accurate method of checking for bit errors in a transmitted signal in the ESF framing format. All of the data bits in one ESF ( $24 \times 193 = 4632$ bits) are considered as one long binary number. This number is divided by another binary number called a constant. The six least significant bits of the remainder are sent as CRC bits during the next ESF. At the receiving end, the same constant is applied to the 4632 bit ESF and the six least significant bits of the remainder are stored and compared with the CRC bits received during the next ESF. Any difference is flagged as a CRC error. Test equipment uses the same constant and algorithm to check for errors in the customer's live data, resulting in the best method of in-service monitoring of circuit quality.
<b>dBdSX</b>	dBdSX is a measure of T1 signal strength in dB relative to a standard 3-volt base to peak signal (6-volt peak-to-peak, $V_{p-p}$ ). Standard measure is 0 dBdSX and is the output of a normal repeater circuit. Correct signal strength at the DSX OUT jack is 0 dBdSX and at the DSX MON jack -20 dBdSX (+ or - 2 dB).

dB dSX	$V_{p-p}$	dB dSX	$V_{p-p}$
+6	11.97	-9	2.13
+3	8.48	-18	0.76
0	6.00	-20	0.60
-3	4.25	-28	0.24
-6	3.01	-30	0.19

(continued)

## **BASIC HI-CAP MAINTENANCE**

### **Technical Information**

#### **ADDITIONAL TERMS, continued**

---

<b><i>Errored Seconds</i></b>	ES - Any second in which one or more bit errors are received.
<b><i>Error Free Seconds</i></b>	EFS - Any one-second period that contains no error events. This is the primary measure service performance and is stated as a percentage over a 24-hour period.
<b><i>Error Insertion</i></b>	Error insertion is a function available on DS1 analyzers that allows the operator the ability to transmit a predetermined number of bit errors on a circuit under test. This is useful in verifying that the signal sent is the signal being monitored.
<b><i>Excess Zeros</i></b>	Excess zeros is a signal containing 16 or more consecutive zeros. Standards require no more than 15 consecutive zeros be transmitted to maintain "ones density" for repeater clock circuits.
<b><i>Frame Error</i></b>	An incorrect value appears in the time slot reserved for the framing bit (bit 193). Frame formats follow a predetermined sequence that can easily be monitored by an extended in-service monitor test with a DS1 analyzer.

---

(continued)

# BASIC HI-CAP MAINTENANCE

## Technical Information

### ADDITIONAL TERMS, continued

#### **Frame Format**

A frame consists of 192 information bits (one 8-bit sample from each of 24 channels) plus a frame bit for a total of 193 bits per frame. The frame bit provides equipment synchronization and other features, depending on the format used.

#### **Super Frame (SF)**

Frame bits used for terminal synchronization and channel signaling.

FRAME NO.	TERM FRAME	SIG FRAME	SIGNAL CHANNEL BIT
1	1	-	
2	-	0	
3	0	-	
4	-	0	
5	1	-	
6	-	1	A (robbed bit 8)
7	0	-	
8	-	1	
9	1	-	
10	-	1	
11	0	-	
12	-	0	B (robbed bit 8)

(continued)

# BASIC HI-CAP MAINTENANCE

## Technical Information

### ADDITIONAL TERMS, continued

#### **Frame Format, continued**

#### **Extended Super Frame (ESF)**

- A 2 kb/s sync. channel, 6 of 24 frame bits
- A 4 kb/s data link channel, 12 of 24 frame bits
- A 2 kb/s cyclic redundancy check channel, 6 of 24 frame bits

FRAME NO.	FRAME BITS			CHAN. SIG.
	Sync	CRC	DATA LINK	
1	-	-	X	
2	-	C1	-	
3	-	-	X	
4	0	-	-	
5	-	-	X	
6	-	C2	-	A
7	-	-	X	
8	0	-	-	
9	-	-	X	
10	-	C3	-	
11	-	-	X	
12	1	-	-	B
13	-	-	X	
14	-	C4	-	
15	-	-	X	
16	0	-	-	
17	-	-	X	
18	-	C5	-	C
19	-	-	X	
20	1	-	-	
21	-	-	X	
22	-	C6	-	
23	-	-	X	
24	1	-	-	D

## **BASIC HI-CAP MAINTENANCE**

### **Technical Information**

#### **ADDITIONAL TERMS, continued**

##### ***Jitter***

The short-term phase variations in the DS1, measured in Unit Interval (UI) time slots of 0.648 usec. Short term implies phase changes faster than 10 times per second (10 Hz). Normally, jitter is a product of metallic span problems.

##### ***Logic Error***

See bit error.

##### ***Loop Code***

A predefined bit pattern recognized by network equipment as a loopback signal command. Loop codes can be either in-band (repetitive channel bits) or out-of-band (ESF framing bits). The network equipment will loop the received signal back to the transmit direction, toward the end sending the loop code. Specific inband loop-up and loop-down codes are:

Equipment	Loop-Up	Loop-Down
NIU 4-bit (FAC1)	1100	1110
NIU 5-bit (FAC2)	11000	11100
CSU	10000	100

PGM = Programmed 3 to 8 bit codes, used in field repeaters.

##### ***Loss of Signal***

LOS exists when the T1 terminal recognizes a loss of receive signal for a duration of 2.0 to 3.0 seconds, also known as a "red" alarm.

##### ***NCI***

Network Channel Interface codes define the electrical and physical interface requirements of a Hi-Cap circuit, such as framing format and line code.

##### ***Ones Density***

A standard designed to provide at least one "ones" bit every eight bits. Ones density standard is 12.5%, see excessive zeros. The ones density requirement is maintained to provide the necessary pulses used for metallic field repeater clock circuits.

(continued)

## **BASIC HI-CAP MAINTENANCE**

### Technical Information

#### **ADDITIONAL TERMS, continued**

<b>Out-of-Frame</b>	OOF condition exists when network equipment recognizes framing bit errors in the range of 2-of-5 to 2-of-4.
<b>Pulse Density</b>	T1 standards are no more than 15 consecutive zeros and in each window of 8 digit time slots at least one "ones" bit shall be present (12.5%). See excess zeros and ones density.
<b>Red Alarm</b>	See Loss of Signal.
<b>RJ48</b>	<i>A standard interface jack for use at the customer's premises, also referred to as the point of termination. The receive signal (side 1 from the network) appears on pins 1 &amp; 2 (T1 &amp; R1). The transmit signal (side 2 to the network) appears on pins 4 &amp; 5 (T &amp; R).</i>
<b>RJ48X</b>	A standard interface jack for use at the customer's premises (POT). An 8-pin jack that provides a metallic loopback of the received signal (pins 1 & 2) to the transmit signal (pins 4 & 5). The RJ48X is normally provided in the NIU smart jack.
<b>Severely Errored Seconds</b>	SES is any one-second interval having a BER worse than $10^{-3}$ . During this condition the service is considered unavailable to the customer.
<b>Side One</b>	The signal transmitted from the local C.O. to the customer (network transmit), normally associated with a metallic span facility.
<b>Side Two</b>	The signal transmitted from the customer to the local C.O. (network receive), normally associated with a metallic span facility.

---

(continued)

## **BASIC HI-CAP MAINTENANCE**

### **Technical Information**

#### **ADDITIONAL TERMS, continued**

---

**Signal Level**      See dBdSX.

**SLC\***      SLC\* is a unique framing format used by AT&T for their subscriber carrier systems.

**Stress Patterns**      See the chart on page 10.

**Wander**      The long-term phase variations in the DS1 measured in Unit Interval (UI) time slots of 0.648 usec. Long-term implies phase changes less than 10 times per second (10 Hz). Wander includes the effects of a constant frequency difference.

**Yellow Alarm**      An alarm signal transmitted in the outgoing direction when a T1 terminal recognizes a loss of signal (LOS) on the receive side.

**ZBTSI**      Zero-Byte Time Slot Interchange is another method of providing zero bit code suppression, not widely used. The most common method used is B8ZS.

---

(continued)

## BASIC HI-CAP MAINTENANCE

### Technical Information

#### **STRESS PATTERNS**

A stress pattern is a predetermined sequence of logical ones and zeros used for testing during DS1 installation and fault isolation. This is called a stress pattern because it stresses T1 equipment and connecting facilities by causing the equipment to operate at the edges of design specifications regarding ones density, consecutive zeros, and coding. The test patterns can be transmitted in the framed or unframed format. The framed format is the recommended standard for network testing and is described below.

PATTERN	DESCRIPTION
QRSS	Pseudorandom sequence which generates every combination of 20-bit word, repeats every 1,048,575 bits, and suppresses consecutive zeros to no more than 14. Contains high-density sequences, low-density sequences, and sequences that change from low to high and visa versa. This pattern is also the standard pattern used to measure jitter.
3 in 24 (framed)	Pattern contains the longest string of consecutive zeros (15), with the lowest ones density (12.5%). This pattern simultaneously stresses minimum ones density and the maximum number of consecutive zeros. The D4 framed format of 3 in 24 may cause a D4 yellow alarm for framed circuits, depending on the alignment of one bits to frame. FO1000100 00000000 00000100 . . .
1:7* (1 in 8) (framed)	Also referred to as "1 in 8" by some test equipment vendors. Only a single one in an 8-bit repeating sequence. This pattern stresses the minimum ones density of 12.5% and should be used when testing facilities set for B8ZS coding as the 3 in 24 pattern increases to 29.5% when converted to B8ZS. May cause a D4 yellow alarm for framed circuits. FO1000000 01000000 01000000 . . .
Min/Max	Pattern contains rapid sequence changes from low density to high density. Most useful when stressing the repeater's ALBO feature.
All ones (framed)	Pattern is composed of ones only. This pattern causes the repeater to consume the maximum amount of power. If DC to the repeater is regulated properly, the repeater will have no trouble transmitting the long ones sequence. This pattern should be used when measuring span power regulation (60 ma or 100 ma or 140 ma).
All Zeros (framed)	Pattern composed of zeros only and must be encoded with either B8ZS or ZBTSl zero suppression before being transmitted to the network. It is effective in finding equipment misoptioned for AMI, such as fiber/radio multiplex low-speed inputs.
2 in 8 (framed)	Pattern contains a maximum of four consecutive zeros. Will not invoke a B8ZS sequence because eight consecutive zeros are required to cause a B8ZS substitution. Pattern is effective in finding equipment misoptioned for B8ZS.
BRIDGTAP*	Bridge taps within a span can be detected by employing a number of test patterns with a variety of ones and zeros densities. This test generates 21 test patterns and runs for 15 minutes. If signal errors occur, the span may have one or more bridge taps. Further sectionalization is required.
MULTIPAT*	This test generates 5 commonly used test patterns to allow T1 span testing without having to select each test pattern individually. Patterns are: All Ones, 1:7, 2in8, 3in24, and QRSS.
2 <sup>20-1</sup> 2 <sup>15-1</sup> 2 <sup>23-1</sup>	These patterns stress circuits beyond specification to determine operating margin. These are optional and should not be used to report network trouble.

\* Available on the TTC T-BERD 209A or 211.

## PRODUCT STANDARDIZATION BULLETIN

BULLETIN NUMBER :1000:  
 REVISION # :03:  
 PRODUCT CLASS :160508:  
 OEM CODE :ZTXT:  
 ISSUE DATE :09/16/93:

PSB TITLE: PTE INDEX - SORT BY PCLASS, PSB

MANUFACTURER: ZTXT = THIS CODE IS FOR TEXT-ONLY PSB'S - NOT VALID IN IMAGE!!  
 123 ANYSTREET  
 ANYCITY, USA 99999  
 ( )

REASON FOR ISSUANCE:

Updated issue of PTE INDEX - BY PRODUCT CLASS AND PSB. This PSB is NOT to be processed through IMAGE, but will be posted to the PSB.BOARD and distributed in hard copy as with other PSB's.

PSB GENERAL DESCRIPTION: PORTABLE TEST EQUIPMENT

This PIR/PSB is being issued to provide an index of GTE Standard Portable Test Equipment. This index is arranged by Product Class code and within a Product Class code by PSB number. Once you find the test set you need, go to the PSB indicated in the index to find additional information for available options, feature descriptions, specifications and available source. Depending on your particular location you may find the PSB in STARS, PRISM or on the Telemail Bulletin Board "PSB.BOARD". To find a particular PSB on PSB.BOARD use the command SCAN SUBJECT "xxxx" where xxxx is the PSB number you need. If you need additional information please contact the Standardization Manager indicated on the respective PSB. This PSB index will be updated in the first quarter and third quarter of the year.

Refer to PSB 1000.1 for the index arranged by OEM, and PSB.

STANDARDIZATION MANAGER: D.AMARASINGHE (214) 718-3631

APPROVED BY: J.L.COKER

<u>OEM Code</u>	<u>Vendor</u>
CANE	Canoga Perkins
COMV	Compression Techniques Corp.
DNTL	3M Dynatel Systems Division
HWPP	Hewlett-Packard Co. Instrument Products
LEAN	Sierra LSI Jennings Company
PMAT	Phoenix Microsystems Inc.
SFSI	Scientific-Atlanta, Inc. (Southern Tool Div.)
SAGM	Siemens Communications Systems, Inc.
SIET	Sage Instruments
TAUM	Tau-Tron Inc.
TCOC	T-Com Corporation
TSYC	Telesync
TTQM	Telecommunications Techniques Corporation
VRLN	Verilynk Corporation
WAGC	Wandel & Goltermann Inc.
WLCM	Wilcom Products Inc. (Div. of Superior Teletec)

PSB #: 1000 R03 PRODUCT CLASS: 160508 OEM: ZTXT ISSUE: 09/16/93

DOWNLOAD INSTRUCTIONS:

All line item numbers followed by a "\*" have either changed since the previous revision or in the case of first issue, are new additions to the PSB. The marked items may include revisions to descriptions, part numbers and/or other fields in addition to inclusion of new items. Therefore, it is imperative that all new or revised items be downloaded to the GTEAMS data bases indicated below.

The following GTE System Standard Indicators are used:

- SSI-1 = Standard
- SSI-2 = Additions & Maintenance
- SSI-3 = One-Time Purchase
- SSI-4 = Field Trial or Provisional (intended to be SSI-1; however, evaluation has not been completed)
- SSI-5 = Non-Standard
- SSI-6 = Unsafe
- SSI-7 = Deplete (at end of life-cycle, GTE Supply will utilize existing stock and can be used as reuse)
- SSI-8 = Obsolete (end of product's useful life cycle)
- SSI-N = Non Domestic Products. (Used in CANTV/other only, not in IMAGE)

The items listed in this PSB issue shall be downloaded to the GTEAMS data base(s) marked with a y:

C: n N: n S: n W: n TATL: n TBTL: n ALL: n

Deployment decision made by:

REPRESENTATIVE: DAVID AMARASINGHE (214) 718-3631

CONTRACT MANAGEMENT NOTES

This is a PSB Index only. Refer to individual PSB's for Central Procurement Information.

GTE STANDARD PORTABLE TEST EQUIPMENT INDEX  
SORTED BY PRODUCT CLASS AND PSB

PRODUCT CLASS NAME TEST SET DESCRIPTION	PCCLASS OEM PART NUMBER	ITEM ID PSB
PCM TEST EQUIPMENT	160201	
INTERFACE RS449 DTE/DCE FOR FB6000	TTQM 41400	377114 NONE
CARD TEST SIGNALING A/B BIT F/9140A	SIET 9144502	885484 3277
SET TEST D4VF 91442-01	SIET 9144201	721615 3277
SET TEST AND ALIGNMENT 91232-04	SIET 9123204	723172 3277
SET TEST AND ALIGNMENT 91232-03	SIET 9123203	717076 3277
ADAPTER MEASURING PAIR	SIET 9107801	700119 3277
SET TEST EXTENDER CHANNEL 431B-1 W/LM-1	LEAN 431B21	365051 3490
ANALYZER BER PRINTING T1 HANDHELD 460A	LEAN 460A	630328 3490
ANALYZER AUTO DIGITAL CXR FAULT 425A-5	LEAN 425A5	720044 3490
SET TEST CABLE PCM 413A TMS W/BATT PK	LEAN 413A	637266 3490
SET TEST EXTENDER CHANNEL UNIT 431B-1	LEAN 431B1	365049 3490
SET TEST REPEATER/LINE PCM 417B TMS	LEAN 417B1	637466 3490
SET TEST EXTENDER CHANNEL UNIT 431B-2	LEAN 431B2	365050 3490
DETECTOR VIOLATION T1/T148C 421A-3	LEAN 421A3	631967 3490
EXTENDER LOOP-BACK T1 E/W 310/PIN JACKS	LEAN 265A	372776 3490
MONITOR PERFORMANCE T-CARRIER 422A-2	LEAN 422A2	630573 3490
SET TEST EXTENDER CHANNEL 431B-2 W/LM-2	LEAN 431B22	365052 3490
MONITOR CHANNEL & PERF DS1 HANDHELD 420A	LEAN 420A	630310 3490
SET TEST REPEATER SPAN PCM 415A-2 TMS	LEAN 415A2	637379 3490
DETECTOR VIOLATION T1/T1C BP 421A-4	LEAN 421A4	639140 3490
SET TEST ACCESS CHANNEL DIG 411B-01	LEAN 411B01	639100 3490
ANALYZER SIGNALING SLC-96 D408 F/D400	WLCM 20027276	630578 3562
DROP & INSERT DS3 D403W OPTION F/D400	WLCM 30403020	630579 3562
ANALYZER STATE SIGNALING T1 D3700 (RACK)	WLCM 30370010	951592 3562
INTERFACE SLC96 DDL D406 OPTION F/D400	WLCM 30406010	630465 3562
SET TEST DIGITAL D400 W/310 JACKS AC PWR	WLCM 30400010	630463 3562
SET TEST DIGITAL D450 W/310 JACKS AC PWR	WLCM 30450010	630576 3562

Page: 4 Date: 10/07/93

PSB #: 1000 R03 PRODUCT CLASS: 160508 OEM: ZTXT ISSUE: 09/16/93

SIGNALING MF/DTMF/DP D402 OPTION F/D400	WLCM 30402010	630542 3562
ANALYZER STATE SIGNALING T1 D3700 (PORT)	WLCM 30370030	865479 3562
BERT OPTION CARD D401 F/D400	WLCM 30401010	630464 3562
DROP & INSERT DS3 D403E OPTION F/D400	WLCM 30403010	630575 3562
SET TEST ACCESS DIGITAL VENCAT-24	DNTL 80610267496	638886 3595
SET TEST FAULT LOCATE PCM MODEL 540A	CANE 540A	637486 3604
ANALYZER TRANSMISSION DS3/DS2/DS1 160A	TCOC 160A	630603 4118
QRS/PRBS STRESS TESTING OPTION F/440B	TCOC 440B05	301904 4118
CODER/DECODER MF/DTMF/DP OPTION F/440B	TCOC 440B06	301905 4118
MONITOR/DEMULTIPLEXER 152B DS3/2/1	TCOC 152B	630230 4118
ENHANCEMENT (T-ACE) OPTION F/440B	TCOC 440B08	347265 4118
DATALINK SLC-96 LUP/BSF FT1 F/235A	TCOC 235A03	630539 4118
MONITOR/DEMUX DS3/2/1 F/440B	TCOC 440B52B	630221 4118
PROGRAM TEST OPTION F/235A	TCOC 235A05	20005014 4118
MONITOR/DEMUX DS1/1C F/440B	TCOC 440B53A1	630222 4118
MONITOR TI-C F/235A (TI-C & DEMUX DS1)	TCOC 235A55A	630541 4118
ADAPTER SPAN POWER F/235A FRONT COVER	TCOC 235A04	20005013 4118
INTERFACE ACCESS DSO OPTION F/440B	TCOC 440B03	301902 4118
MONITOR DSO F/235A (NOISE & FREQUENCY)	TCOC 235A54B	630540 4118
INTERFACE RS232C OPTION F/152B	TCOC 152B01	630231 4118
INTERFACE RS232C OPTION F/440B	TCOC 440B04	301903 4118

TRANSMISSION T1 235A  
 TEST ACCESS CHANNEL DS1 440B (DUAL)  
 TEST DIGITAL S5104 DS1-DS1C-DS2  
 5110 T1 SGNL & PERFORMANCE  
 TEST DIGITAL S5104 W/JITTER INJ/MEAS  
 TEST DIGITAL DS3/DS1 5300 W/358 JACK  
 ACCESS DS3/DS1 DEMULTIPLEXER 5328  
 5110 FIELD PACK W/PRINTER  
 OPTION MEASUREMENT ENHANCEMENT F/AT9500D  
 ANALYZER DS3/DS1 TRANS. DIG DUAL AT9500D  
 SET TEST BERT DS3 W/RECH.BATT/OPT.CARD  
 OPTION POWER DC/AC F/AT9500D  
 OPTION SIGNAL ANALYSIS F/AT9500  
 SET TEST WAVEFORM DS3/DS1 A931  
 OPTION DS3/DS1 CHL XMIT F/AT9500  
 OPTION DC/AC POWER F/AT9500  
 ANALYZER DS3/DS1 TRANS. DIGITAL AT9500  
 OPTION DS3/DS1 CHL XMIT F/AT9500D  
 GENERATOR 2048 KBIT/S F/PRA-1 ANALYZER  
 METER JITTER PCM PJM-1 T1/T2  
 MODULE BIT ERROR MEASUREMENT F/PRA-1  
 METER JITTER PCM PJM-1 T1/T1C  
 ANALYZER FRAME PRA-1 PCM 2048 KBIT/S  
 MODULE CRC F/PRA-1 FRAME ANALYZER  
 BOARD INTERFACE W/IEEE-488 F/PRA-1  
 SET TEST TMS DIGITAL  
 SET TEST DS1/DSO HP3787B  
 SET TEST TRANSMISSION DS3/DS1 HP3789B  
 KIT TIP FOR 545A PROBE

TCOC	235A	20005010	4118
TCOC	440B	300980	4118
TAUM	950575734	638848	4654
TAUM	A710001900	864811	4654
TAUM	950575738	631706	4654
TAUM	9507603605	630324	4654
TAUM	95070200	630325	4654
TAUM	A710001900FP	861520	4654
SFSI	AT9500D3	630443	4657
SFSI	AT9500D	630252	4657
SFSI	AT9300	630476	4657
SFSI	AT9500D2	630442	4657
SFSI	AT95001	633090	4657
SFSI	A931	860227	4657
SFSI	AT95004	335799	4657
SFSI	AT95002	633091	4657
SFSI	AT9500	633089	4657
SFSI	AT9500D4	630444	4657
WAGC	BN20160001	632985	4658
WAGC	BN985002	634734	4658
WAGC	BN20160002	632986	4658
WAGC	BN985003	630118	4658
WAGC	BN201601	632984	4658
WAGC	BN20160003	632987	4658
WAGC	BN95821	632988	4658
VRLN	4019NYP	638776	4659
HWPP	HP3787B	632312	4662
HWPP	HP3789B	831168	4662
HWPP	HP0054560104	573718	4662

Page: 5 Date: 10/07/93

PSB #: 1000 R03 PRODUCT CLASS: 160508 OEM: ZTXT ISSUE: 09/16/

SET TEST BER HP4925B	HWPP	HP4925B	631282	46
OPTION BATTERY-POWER F/HP 3787B	HWPP	HP3787B002	831157	4664
OPTION DS1 JITTER F/HP 3787B	HWPP	HP3787B001	632576	4662
OPTION VF CHANNEL F/HP 3787B	HWPP	HP3787B003	630276	4662
PROBE LOGIC HP545A (CMOS & TTL)	HWPP	HP545A	635868	4662
ANALYZER COMMUNICATIONS FIREBERD 6000	TTQM	FIREBERD6000A	632629	4664
ANALYZER T-CARRIER T-BERD 209A	TTQM	TBERD209A	632931	4664
ANALYZER T-CXR T-BERD 209OSP	TTQM	TBERD209OSP	630496	4664
INTERFACE CCITT 2.048M/NX64KB/S	TTQM	41800	359962	4664
ANALYZER T-CXR W/JITTER-M T-BERD 211	TTQM	TBERD211	633094	4664
MONITOR T-CXR W/AC A/C&CC	TTQM	TBERD107A	373642	4664
SET TEST DROP & INSERT T-BERD 224	TTQM	TBERD224	630301	4664
ANALYZER DDS & PCM FIREBERD 4000	TTQM	FIREBERD4000	630268	4664
MONITOR T1 DUAL LINE REMOTE T-BERD 121	TTQM	TBERD121	630470	4664
SCOPE INTEGRATED PROTOCOL DATA (64K) FOR	TTQM	PDS45	377115	4664
SET TEST COMMUNICATION 930A TMS	SAGM	930A	857908	4669
SET TEST INTERFACE COMMUNICATION 1500A	PMAT	F1500000A101	630330	4670
SET TEST BERT T1 5575B W/HDW & SFTWR BAT	PMAT	F5575201B1113	367554	4670
SET TEST DSO DROP/INSERT SLC 96 F/5575B	PMAT	F5596001A110	367646	4670
SET TEST CEPT QUICK MODEL 1541 2048	PMAT	F154100211	367291	4670
SET TEST DSO DROP/INSERT SLC 96 W/MF REC	PMAT	F5596001A111	367650	4670
SET SEND CEPT QUICK MODEL 1542 CEPT	PMAT	F154200211	367293	4670
SET TEST COMMUNICATIONS ANALYZER T3/T1 DIG	PMAT	F5700003A111	367664	4670
MONITOR BAY T1/T1C MODEL 5200	PMAT	F5200001111	861870	4670
SET SEND T1 QUICK MODEL 1542 T1	PMAT	F154200111	367292	4670
SET TEST T1E1 QUICK "E" MODEL 1543	PMAT	F154300111	630303	4670
SET TEST BERT T1 5575B W/BATTERY	PMAT	F5575101B1111	630593	4670
SET TEST BERT MEGALINK G.703	PMAT	F5575002A111	630316	4670

SET TEST T1 QUICK MODEL 1541 T1	PMAT	FL541001A11	367290	4670
ANALYZER BERT 5500A W/IEEE-488 & RS232	PMAT	FS5000000A11110	303311	4670
ANALYZER CHANNEL/BERT T1 SLC96 T-STAR	COMV	TSTAR1096A	630424	4875
ANALYZER CHANNEL/BERT T1 T-STAR 1500	COMV	TSTAR1500	630423	4875
SET TEST PORTABLE DS3 COMPARATOR	TSYC	TSI45221	630446	6788
SET TEST PORTABLE DS1 COMPARATOR	TSYC	TSI15221	630445	6788

PROTECTION TEST EQUIPMENT 160307

MULTIMETER CORROSION B-3-A2 (* NO LEADS)	MCNL	00908	630594	1036
TESTER INSULATION AC-PWR/HAND-CRANKED	BDDL	212359CL	631638	3273
TESTER RESISTANCE GROUND	BDDL	250202	630327	3273
TESTER RESISTANCE GROUND RAT-PWR 4-TERM	BDDL	250502	630471	3273
KIT POWER ANALYZER - 1B	ECOI	PAK1B	301701	5401
KIT ELECTRICAL INSPECTION EIK-2A	ECOI	EIK2A	301708	5401

MULTIMETERS 160501

PSB #: 1000 R03 PRODUCT CLASS: 160508 OEM: ZTXT ISSUE: 09/16/93

MULTIMETER ANALOG MODEL 260-8XI	SPNE	12395	346591	1500
MULTIMETER MODEL 310-C	TPLT	3022	576544	3294
PROBE UNIVERSAL TEMPERATURE	FLUK	80T150U	882704	3438
MULTIMETER HANDHELD DIGITAL MODEL 83	FLUK	83	870038	3438
MULTIMETER HANDHELD DIGITAL MODEL 12	FLUK	12	342048	3438
MULTIMETER HANDHELD DIGITAL MODEL 85	FLUK	85	870037	3438
MULTIMETER BENCHTOP DUAL DISPLAY MODEL 45	FLUK	45	309093	3438
PROBE HIGH FREQUENCY F/FLUKE	FLUK	85RF	631276	3438
MULTIMETER HANDHELD DIGITAL MODEL 77-2	FLUK	772	639087	3438
MULTIMETER HANDHELD DIGITAL MODEL 87	FLUK	87	839202	3438
MULTIMETER BENCHTOP DIGITAL MODEL 8010A	FLUK	8010A	638825	3438
VOLTMETER WIDEBAND W/COUNTER	FLUK	8920A03	632185	3438
MULTIMETER HANDHELD DIGITAL MODEL 8060A	FLUK	8060A	631425	3438
PROBE CURRENT CLAMP-ON	FLUK	Y8100	631275	3438
PROBE CLAMP-ON AC/DC CURRENT	FLUK	80I410	846623	3438
MULTIMETER BENCHTOP DIGITAL W/OPT 01	FLUK	8010A01	634735	3438
MULTIMETER HANDHELD DIGITAL MODEL 10	FLUK	10	342050	3438
PROBE CLAMP-ON AC/DC CURRENT	FLUK	80I1010	309096	3438
MULTIMETER HANDHELD DIGITAL MODEL 75-2	FLUK	752	639099	3438
THERMOMETER DIGITAL MULTIPOINT	FLUK	2166A	637478	3438
MULTIMETER HANDHELD DIGITAL MODEL 79-2	FLUK	792	336505	3438
PROBE CLAMP-ON AC CURRENT 1-600A 2"	FLUK	80I600	529464	3438
VOLTMETER TRUE RMS ANALOG BENCHTOP	HWPP	HP3400A	637149	4620
MULTIMETER PRECISION DIGITAL BENCHTOP	HWPP	HP3457A	332372	4620

# Special Service Circuits Safeguarding and Marking

## Contents

Subject	Page
<b>1. General</b> .....	<b>2</b>
1.1 Purpose .....	2
1.2 Filing Instructions and Supersedures .....	2
1.3 Reason for Reissuing .....	2
1.4 Responsibility .....	2
1.5 Disclaimer .....	2
<b>2. Overview</b> .....	<b>3</b>
2.1 Introduction .....	3
2.2 Definitions .....	3
2.3 Reference .....	3
<b>3. Safeguarding</b> .....	<b>4</b>
3.1 Circuits Requiring Safeguarding .....	4
3.2 Safeguarding Requirements .....	4
3.3 Maintenance Precautions .....	4
<b>4. SS7 Requirements</b> .....	<b>5</b>
4.1 Introduction .....	5
4.2 Power Equipment Labeling .....	5
4.3 Bay Labeling .....	5
4.4 Local Records .....	6
4.5 Carrier Bay Labeling .....	6
4.6 Distribution Frame Safeguards .....	6
<b>5. Standard Safeguard Devices</b> .....	<b>7</b>
5.1 Devices .....	7

## 2. Overview

### 2.1 Introduction

Many telecommunications services require added precautions during installation, facility rearrangement, and maintenance. These services are designated as special service lines. Because momentary accidental contact with a circuit can cause a service degradation or interruption, GTE employees must take extra precautions to prevent such contact.

Safeguard devices provide electrical insulation protection and visual identification for mainframe terminals, jack fields, and outside plant (OSP) terminals. The appropriate device provides both access and security for wire-wrap, lug, punch-down, and solder connections.

This practice describes the devices and methods GTE uses to label and safeguard special service circuits.

### 2.2 Definitions

The following chart defines the acronyms and terms used in this practice.

Acronym or Term	Definition
CCS	Common Channel Signaling
CCSF	Common Control Signaling Frame
CDF	Combined Distribution Frame
CFB	Carrier Fuse Bay
CKT	Circuit
CO	Central Office
DTE	Data Terminal Equipment
FAA	Federal Aviation Administration
MDF	Main Distribution Frame
MISF	Miscellaneous Intermediate Distribution Frame
OSP	Outside Plant
PDF	Protector Distribution Frame
PDUP	Power Distribution Frame
SS7	Signaling System 7
SSCC	Special Service Control Center
SSOC	Switching Service Operation Center
TSP	Telecommunications Service Priority

### 2.3 Reference

For additional information related to this practice, see GTE Telephone Operations Practices in the 244-xxx-xxx series.

## 4. SS7 Requirements

### 4.1

### SS7

#### Introduction

CO personnel is responsible for safeguarding and marking all SS7 circuits in accordance with this practice. The circuits and equipment must be readily identifiable as special service circuits on all distributing frames and equipment frames as described in the following sections.

All labeling is performed using removable orange labels. Labels may be obtained from the SS7 Control Group. The form numbers are as follows:

- Critical SS7 CKT, Form 000740PS.
- Caution Contains Critical SS7 Equipment, Form 000739PS.
- Contains Critical SS7 Circuit, CKT#, Form 000741PS.

**NOTE:** Refer to the 244-xxx-xxx series of GTE Telephone Operations Practices for additional labeling information.

### 4.2

### Power

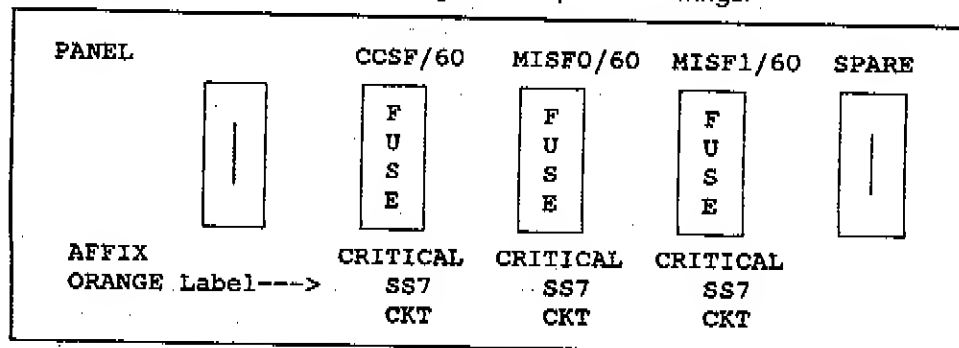
### Equipment Labeling

For power distribution frames (PDUFs) and carrier fuse bays (CFBs), etc., label the individual fuse positions supplying power to SS7 equipment and channel banks containing SS7 signaling links (HW-CKTs) in accordance with the following guidelines and illustration.

1. Use a label that reads *CRITICAL SS7 CKT*, as shown below.



2. The label can be affixed above or below the distribution fuse, depending on which is more visible from a standing position.
3. Avoid placing a label on the removable fuse holder. The label must not mask current labeling, such as fuse size or feed.
4. Verify fuse size and feed labeling with CO power drawings.



### 4.3

### Bay Labeling

On an SS7 bay, e.g., a common control signaling frame (CCSF) bay, affix a label that reads *CAUTION CONTAINS CRITICAL SS7 EQUIPMENT*. See the illustration below.




## 5. Standard Safeguard Devices

### 5.1 Devices

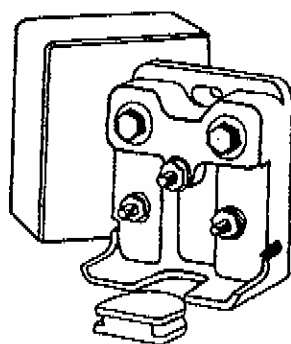
The following chart lists the standard safeguard devices used on special service circuits. The chart features:

- Descriptions of each device.
- Illustrations of:
  - The device.
  - The device's application.
- Part numbers and material codes used to obtain these items.

**NOTE:** Follow standard requisition procedures to order the devices.

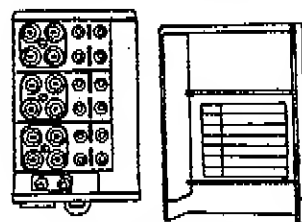
Item	Sketch	Part Number	Material Code
Cap binding post red (lug term)		TCR	524694

#### Application



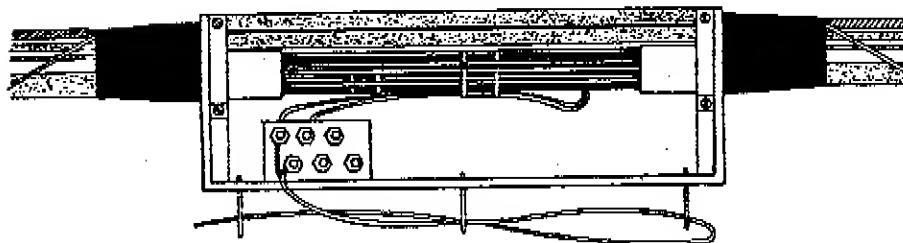
Type 500

Typical Protectors that Utilize the Basic 492 Module



502 Station Protector


Aerial Terminal



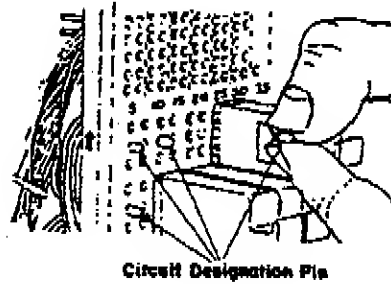
(continued)


## 5. Standard Safeguard Devices, continued

### 5.1 Devices, continued

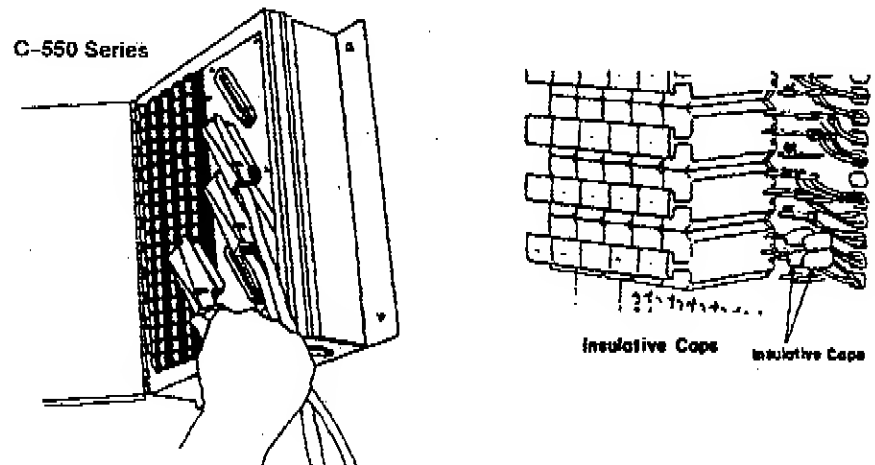
Item	Sketch	Part Number	Material Code
Pin designation circuit red		303-1020	746053

#### Application



Marker cap red		C675	766623
----------------	---	------	--------

#### Application


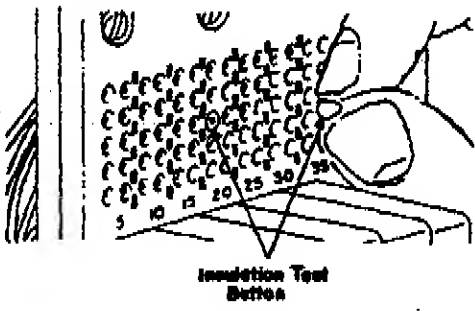

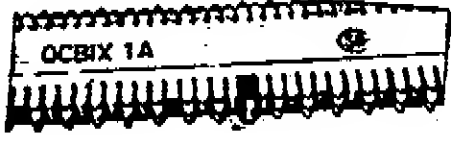

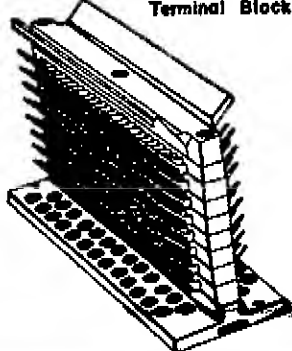



(continued)

## 5. Standard Safeguard Devices, continued

5.1

Devices,  
continued

Item	Sketch	Part Number	Material Code
Insulator point test		303-1019	582272
Application	 <p>Insulation Test Button</p>		
Guard special service		C-BIX-23A	552748
Application	 <p>BIX Connector</p>		
Marker wire $\frac{3}{8}$ red		KS-6660	524053
Application	 <p>Terminal Block</p>		
Insulator binding		67983	

### **Basic Hi-Cap Maintenance Questions**

1. Which of the following answers best describes your functional work group?
  - A. C.O. Maintenance
  - B. C.R.C.C. (Facility HUB)
  - C. Span Maintenance
  - D. Special Services Technician
  - E. Other
  
2. Which of the following answers best describes your knowledge and experience level of DS1 Hi-Cap trouble isolation?
  - A. Extremely knowledgeable
  - B. Knowledgeable
  - C. Somewhat knowledgeable
  - D. No knowledge
  
3. What is a DS1 Hi-Cap?
  - A. High-resolution data signal
  - B. Private line CKT at 1.544 Mb/s
  - C. Private line CKT at 64 kb/s
  - D. Greeting to the ship's captain
  
4. Which of the following equipment is not the responsibility of a GTE telco?
  - A. CSU
  - B. NIU
  - C. MDF
  - D. OTR
  - E. Cosmic Frame
  
5. Who is currently GTE's largest customer?
  - A. Piggly Wiggly market chain
  - B. AT&T
  - C. Standard Oil
  - D. The ACLU

6. The NIU device is \_\_\_\_\_.
- A. A remote loopback device
  - B. Point of DeMarc
  - C. Powered from the C.O.
  - D. Telco equipment
  - E. All of the above
7. The DSX is permanently cabled to the \_\_\_\_\_.
- A. CSU
  - B. NIU
  - C. MDF
  - D. OTR
  - E. All of the above
8. The DSX "MONITOR" jack is used to check the signal on the \_\_\_\_\_.
- A. Span toward the NIU
  - B. Test set RCV jack
  - C. DSX "IN" jack
  - D. DSX "OUT" jack
9. What device will isolate the inside equipment from the outside facilities?
- A. NIU
  - B. MDF protector module
  - C. Cable head
  - D. OTR
10. C.O. Maintenance responsibilities for DS1 Hi-Caps include:
- A. Isolating trouble
  - B. Maintaining SSMO treatment
  - C. Service restoration
  - D. Retaining Hi-Cap FLRs
  - E. All of the above

11. Which of the following tests must a Hi-Cap test set be capable of performing?
- A. NIU Loop-Up/Down
  - B. Multiple DS1 Test patterns
  - C. Analyze live and test signals
  - D. All of the above
12. What two jacks must be connected with a patch cord to monitor a Hi-Cap?
- A. Test set XMT and DSX MON
  - B. Test set RCV and DSX OUT
  - C. Test set RCV and DSX MON
  - D. Test set XMT and DSX IN
13. A NIU loop test has little impact on customer service.
- A. True
  - B. False
14. Normal span current of 60 ma is measured at the OTR as:
- A. .06 VDC
  - B. .6 VDC
  - C. 6.0 VDC
  - D. 60 ma
15. When isolating span power problems at the MDF you must first:
- A. Remove the modules
  - B. Remove the OTR
  - C. Loop the DSX
  - D. Measure continuity
16. What precaution must you take before performing intrusive testing?
- A. Warn the customer
  - B. Check for SSMO treatment
  - C. Obtain authorization from CRCC
  - D. Perform monitor tests

17. What indicators are displayed on the T-Berd 209A test set on a normal Hi-Cap circuit?

- A. All Ones, Ones Density
- B. T1 Pulses, All Results OK
- C. BPV & Frame, All Results OK
- D. Signal Loss, Loop-up

## **COURSE COMPLETION FORM**

**SATELLITE BROADCAST  
REQUEST TO ADD COURSE COMPLETION  
TO EMPLOYEE'S TRAINING RECORD**

**BASIC HI-CAP MAINTENANCE - LAB**  
**COURSE NO. 50403**

# Basic Hi-Cap Maintenance - Lab

## Course No. 50403

**Instructions:** To receive credit for the Basic Hi-Cap Maintenance - Lab, Course NO. 50403, complete and return the form below.

Arrange time with your supervisor to perform the following hands-on activities after attending the Basic Hi-Cap Maintenance broadcast, Course No. 50402. Check ✓ the "COMP" column for activities completed. Print your name and SSN, sign the sheet, and present it to your supervisor. Your supervisor will approve the activity sheet and return the form for employee training records update. All activities *must* be satisfactorily completed within 60 days after attending Course No. 50402.

ITEM	PERFORMANCE ACTIVITY	COMP
1	Perform a DS1 test equipment inventory and verify proper equipment calibration by inspection of the calibrate tab.  a. Digital VOM b. DS1 Analyzer (T-209A or equivalent)	
2	Perform a Special Service Circuits Safeguarding and Marking (SSMO) audit on 2 or more circuits. Refer to GTEP 200-050-101, Issue 4, Dec. 1992.	
3	Using a T-BERD 209A or like DS1 analyzer, perform a cord test on all patch cords intended for use at the DSX.	
4	Locate the Hi-Cap FLR files in your office(s).	
5	Locate all Hi-Cap equipment shelves in your office(s).	
6	Identify a spare <i>non-service</i> carrying Hi-Cap facility in one of your offices.  <b>WARNING:</b> You <i>must</i> verify the circuit to be tested is a spare facility. Do <b>NOT</b> attempt to test a customer's live circuit.	
7	Using the spare Hi-Cap facility, perform an "In-Service Monitor" on the local facility.	
8	Using the spare Hi-Cap facility, perform an "NIU Loop" test on the local facility.	
9	Using the spare Hi-Cap facility, perform "Span Power & Continuity Measurements" on the local facility.	

The above training course activities were completed by:

Print Student Name: \_\_\_\_\_ SSN: \_\_\_\_\_

Student signature: \_\_\_\_\_ Date: \_\_\_\_\_

Supervisor approval: \_\_\_\_\_ Date: \_\_\_\_\_

**This form must be completed and returned to:  
Education & Training - HQD02A04 - Irving, Texas**

(Staple)

**To:**

**EDUCATION & TRAINING - HQD02A04**

**Irving, Texas**

---

(Fold)

